**3GPP TSG RAN WG1 #106 R1-21xxxxx**

**e-Meeting, August 16th – 27th, 2021**

**Agenda Item: 6**

**Source: Moderator (ZTE)**

**Title: [106-e-LTE-6CRs-01] Email discussion/approval on NPUSCH postponement when overlapping with NPRACH**

**Document for: Discussion and Decision**

# Introduction

This document provides discussion on clarification on NPUSCH postponement for NB-IoT:

[106-e-LTE-6CRs-01] Email discussion/approval on NPUSCH postponement when overlapping with NPRACH – YouJun (ZTE)

Issue 1: Triggering case 1 NPUSCH postponement when overlapping with NPRACH(R1-2106839, R1-2108119,R1-2106561)

Issue 2: More triggering cases for triggering NPUSCH postponement when overlapping with NPRACH (R1-2106561, R1-2107686, R1-2106840)

Discussion and decision by 8/18, CR by 8/20, final check by 8/24

# Discussion

## Issue 1: Triggering case 1 NPUSCH postponement when overlapping with NPRACH (R1-2106839, R1-2108119, R1-2106561)

For this Rel-14 modification on the NPUSCH postponement, there are some reasons collected from R1-2106839, R1-2108119, R1-2106561 and they are shown in table 1.

Table 1. Issue 1 clarification on NPUSCH postponement in Rel-14

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|  | Reason for change |
| R1-2106839 [1] | In Clause 10.1.3.6 of TS36.211, the following triggering case for NPUSCH postponement is not captured in Rel-14 specification:  when a UE performs a random access procedure on non-anchor carrier in which case the NPRACH resource is implicitly indicated  Besides, in Clause 10.1.3.6 of TS36.211, ”if it overlaps with any configured NPRACH resource according to *nprach-ParametersList* and the UE indicates *multiCarrier-NPRACH* as supported” refers to the triggering case for NPUSCH postponement on non-anchor carriers. In fact, we can see that *nprach-ParametersList* can be configured in both *NPRACH-ConfigSIB-NB* and *SystemInformationBlockType22-NB,* wherein the former one is used for NPRACH configuration on an anchor carrier, the latter one is used for NPRACH configuration on non-anchor carriers. Therefore, there exists some overlapping triggering conditions in the two triggering cases described in Clause 10.1.3.6 of TS36.211. A clarification is needed. |
| R1-2108119 [2] | In clause 10.1.3.6, where the NPUSCH postponement is described, the case when the UE capability is not available at the eNodeB has not been addressed. That is, when a UE performs a random-access procedure in which case the NPRACH resource is implicitly indicated. |
| R1-2106561 [3] | Based on the latest Rel-14 spec, it only specifies that NPUSCH will be postponed after the UE indicates *multiCarrier-NPRACH* as supported. It means that during RACH procedure, there is no postpone operations i.e. no collisions between Msg3 NPUSCH and NPRACH. If RAN1 wants to change this behavior, it may not be backward compatible since the eNB cannot know whether the UE supports this new postpone behavior or not during RACH procedure. Thus for Rel-14 NPRACH resources, we think backward compatibility should be considered, and the fact that the release is long frozen. And we can reuse Rel-14 behavior considering that Rel-14 is a frozen and deployed release, and no critical issues and no room for Rel-14 changes.  **Proposal 2: Do not change Rel-14 specifications for NPRACH/NPUSCH postponement.** |

**Question 1: Do you agree to make a Rel-14 modification on the NPUSCH postponement according to the provided motivation in table 1?**

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| **Companies** | **Comments** |
| Ericsson | Yes, given that the intention is to clarify case-by-case.  Moreover, [3] mentions “*during RACH procedure, there is no postpone operations i.e. no collisions between Msg3 NPUSCH and NPRACH*.” However, there is no guarantee of “*no collisions between Msg3 NPUSCH and NPRACH*”. That is, collisions can occur and that is the whole point of the Rel-14 CR since in case of collision the same postponement behavior as in other cases applies which is meant to be clarified. |
| Lenovo, MotoM | Yes, we agree to make Rel.14 modification. |
| Huawei/HiSilicon | We don’t agree the Rel-14 modification since it is non-backward compatible.  Based on the latest Rel-14 spec, it only specifies that NPUSCH will be postponed after the UE indicates *multiCarrier-NPRACH* as supported. It means that during RACH procedure, there is no postpone operation for legacy Rel-14 UEs. If changing it to postpone, then how does the gNB know whether a UE is new UEs who supports this new postpone behavior or a legacy Rel-14 UE who does not support postpone during RACH procedure. |
| ZTE, Sanechips | From our perspective of view, when a R14 UE performs a random access procedure on non-anchor carrier, UE can postpone the NPUSCH if a collision between NPUSCH and NPRACH. This kind of clarification make the spec more clearer and no any new UE behavior is introduced. Therefore, we support to make a R14 modification.  If it is certainly confirmed that there exist the backward compatible issues(new UE behavior) for some products, we are also OK to keep the legacy description, since eNB can not distinguish it is a legacy R14 UE or new R14 UE with new UE behavior during RACH procedure. |
| Nokia, NSB | We are OK to make Rel 14 modification |

If there exists the necessity to make a modification on the NPUSCH postponement in Rel-14, the following TPs provided by R1-2106839, R1-2108119, can be considered.

**TP1 in R1-2106839**

**10.1.3.6 Mapping to physical resources**

**<Unchanged parts are omitted>**

If a mapping to  slots or a repetition of the mapping contains a resource element which overlaps with

- any configured NPRACH resource according to *NPRACH-ConfigSIB-NB*, or

- any configured NPRACH resource according to *nprach-ParametersList* in *SystemInformationBlockType22-NB* and the UE indicates *multiCarrier-NPRACH* as supported, or

- any NPRACH resource according to *nprach-ParametersList* in *SystemInformationBlockType22-NB* and utilized by the UE during random access procedure

- for  the NPUSCH transmission in overlapped slots is postponed until the next  slots not overlapping with any configured NPRACH resource.

- for  the NPUSCH transmission in overlapped  slots is postponed until the next  slots starting with the first slot satisfying and not overlapping with any configured NPRACH resource.

**<Unchanged parts are omitted>**

**TP2 in R1-2108119**

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10.1.3.6 Mapping to physical resources

NPUSCH can be mapped to one or more than one resource units, , as given by clause 16.5.1.2 of 3GPP TS 36.213 [4], each of which shall be transmitted  times.

----------------------------------------------------------------- Text Omitted ---------------------------------------------------------

If a mapping to  slots or a repetition of the mapping contains a resource element which overlaps with any NPRACH resource utilized by a UE that performs a random access procedure which can correspond to NPRACH format 0 or format 1 of frame structure type 1 on non-anchor, or any configured NPRACH resource according to *NPRACH-ConfigSIB-NB*, or if it overlaps with any configured NPRACH resource according to *nprach-ParametersList* and the UE indicates *multiCarrier-NPRACH* as supported

- for  the NPUSCH transmission in overlapped slots is postponed until the next  slots not overlapping with any configured NPRACH resource.

- for  the NPUSCH transmission in overlapped  slots is postponed until the next  slots starting with the first slot satisfying and not overlapping with any configured NPRACH resource.

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Based on the above TPs, if there exist the necessity to make a Rel-14 spec modification on the NPUSCH postponement, we need to discuss which TP should be adopted as the starting point.

**Question 2: If a Rel-14 modification on the NPUSCH postponement is agreed, which TP (TP1 or TP2) is preferred as the starting point to address the NPUSCH postponement overlapping issue in Rel-14?**

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| **Companies** | **Comments** |
| Ericsson | TP1 in R1-2106839 and TP2 in R1-2108119, attempt to cover the Rel-14 case. We propose the following hybrid TP which is more aligned with TP4 in R1-2106840 which is the one covering both the Rel-14 case and the Rel-15 cases.  **<Unchanged parts are omitted>**  If a mapping to  slots or a repetition of the mapping contains a resource element which overlaps with any NPRACH resource utilized by a UE that performs a random access procedure which can correspond to *nprach-ParametersList* in *SystemInformationBlockType22-NB*, or anyconfigured NPRACH resource according to *NPRACH-ConfigSIB-NB*, or if it overlaps with any configured NPRACH resource according to *nprach-ParametersList* in *SystemInformationBlockType22-NB* and the UE indicates *multiCarrier-NPRACH* as supported  - for  the NPUSCH transmission in overlapped slots is postponed until the next  slots not overlapping with any configured NPRACH resource.  - for  the NPUSCH transmission in overlapped  slots is postponed until the next  slots starting with the first slot satisfying and not overlapping with any configured NPRACH resource.  **<Unchanged parts are omitted>** |
| Lenovo, MotoM | We slightly prefer TP1. It seems more aligned with legacy text. |
| Huawei/HiSilicon | Same comments as question 1. |
| ZTE, Sanechips | We are OK with TP1 and also fine with the update from Erisson if supported. |
| Nokia, NSB | We are fine with Ericsson’s proposal |

## Issue 2: More triggering cases for triggering NPUSCH postponement when overlapping with NPRACH (R1-2106561, R1-2107686, R1-2106840)

Issue 2 is Rel-15 related. There are some reasons collected from R1-2107686 (R1-2106561) and R1-2106840, and they are shown in table 2.

Table 2. Issue 2 clarification on NPUSCH postponement in Rel-15

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|  | Reason for change |
| R1-2107686 [4] | In RAN1#95 meeting the following was agreed.  *Agreement:*  *For the new NPRACH resources introduced in Rel-15,*   * *For non-EDT NPRACH resources, the UE postpones NPUSCH in those resources only if the UE indicates support for the corresponding feature(s).* * *For EDT NPRACH resources, the UE postpones NPUSCH in those resources only during an EDT procedure*   However in Clause 10.1.3.6 of TS36.211, the following cases for NPUSCH postponement are missed in Rel-15 specification   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Case #** | **NPRACH preamble** | **Carrier** | **UE capability** | **RRC Configuration** | | 1 | Legacy(i.e. Format 0/1) | Non-anchor | *multiCarrier-NPRACH* and *mixedOperationMode* | *SystemInformationBlockType22 > ul-ConfigListMixed-r15* | | 2 | Format 2 | Non-anchor | *multiCarrier-NPRACH* and *nprach-Format2* | *SystemInformationBlockType23-NB-r15 > ul-ConfigList-v1530 > nprach-ParametersListFmt2-r15* | | 3 | Format 2 | Non-anchor | *multiCarrier-NPRACH*, *mixedOperationMode* and *nprach-Format2* | *SystemInformationBlockType23-NB-r15 > ul-ConfigListMixed-v1530 > nprach-ParametersListFmt2-r15* | | 4 | Format 2 | Anchor | *nprach-Format2* | *SIB2 > RadioResourceConfigCommonSIB-NB-r13 > nprach-ParametersListFmt2-r15* | | 5 | TDD | Anchor | *[NOTE1]* | *SIB2 > RadioResourceConfigCommonSIB-NB-r13 > nprach-ParametersListTDD-r15* | | 6 | TDD | Non-anchor | *multiCarrier-NPRACH*  *[NOTE1]* | *SystemInformationBlockType22 > ul-ConfigCommonListTDD-NB-r15>* *nprach-ParametersListTDD-r15* | | *NOTE1: No explicit capability for TDD NPRACH* | | | | | |
| R1-2106840 [5] | In Clause 10.1.3.6 of TS36.211, the following triggering cases for NPUSCH postponement are not included in Rel-15 specification:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Case #** | **NPRACH preamble** | **Carrier** | **UE capability** | **RRC Configuration** | | 1 | Legacy(i.e. Format 0/1) | Non-anchor | *multiCarrier-NPRACH* and *mixedOperationMode* | *SystemInformationBlockType22 > ul-ConfigListMixed-r15* | | 2 | Format 2 | Non-anchor | *multiCarrier-NPRACH* and *nprach-Format2* | *SystemInformationBlockType23-NB-r15 > ul-ConfigList-v1530 > nprach-ParametersListFmt2-r15* | | 3 | Format 2 | Non-anchor | *multiCarrier-NPRACH*, *mixedOperationMode* and *nprach-Format2* | *SystemInformationBlockType23-NB-r15 > ul-ConfigListMixed-v1530 > nprach-ParametersListFmt2-r15* | | 4 | Format 2 | Anchor | *nprach-Format2* | *SIB2 > RadioResourceConfigCommonSIB-NB-r13 > nprach-ParametersListFmt2-r15* | | 5 | TDD | Anchor | *[NOTE1]* | *SIB2 > RadioResourceConfigCommonSIB-NB-r13 > nprach-ParametersListTDD-r15* | | 6 | TDD | Non-anchor | *multiCarrier-NPRACH*  *[NOTE1]* | *SystemInformationBlockType22 > ul-ConfigCommonListTDD-NB-r15>* *nprach-ParametersListTDD-r15* | | 7 | any NPRACH resource utilized by a UE that performs a random access procedure which can correspond to NPRACH format 2 of frame structure type 1, or NPRACH format 0 or format 1 of frame structure type 1 on non-anchor carriers, or frame structure type 2 on non-anchor carriers, or mixed operation mode. | | | | | *NOTE1: No explicit capability for TDD NPRACH* | | | | | |

As discussed in RAN1 #105-e meeting [6], the NPUSCH postponement issue in Rel-15 actually reached to the consensus regarding case #1~6. For case 7 in [5], most companies agreed to capture this missing case. However, there was no consensus for the specified clarification of case 7. Therefore, based on the above motivation and discussion in last 2 meetings, it is hoped that we can make more progress in this meeting.

**Question 3: Do you agree to make a Rel-15 clarification on the NPUSCH postponement to capture the missing cases (1~6)?**

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| **Companies** | **Comments** |
| Ericsson | Only if the so called “Case #7” is included. Specially because the CRs are intended to clarify case-by-case. |
| Lenovo, MotoM | Yes, we agree the clarification for case 1-6. |
| Huawei/HiSilicon | We agree the clarification for case 1-6. |
| ZTE, Sanechips | We agree to make a Rel-15 clarification for case 1~6 |
| Nokia, NSB | We are fine with 1-6 |

**Question 4: Do you agree to make a Rel-15 clarification on the NPUSCH postponement to capture the missing cases 7?**

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| **Companies** | **Comments** |
| Ericsson | Yes, in the answer to Question 1 we have explained why is needed if the intention is to clarify all cases. |
| Lenovo, MotoM | Yes, we agree the clarification for case 7 |
| Huawei/HiSilicon | As commented in question 1, case 7 is non-backward compatible. |
| ZTE, Sanechips | Yes, we agree to capture case 7. Different with R14 modification, there is an agreement indicating some Rel-15 NPUSCH postponement scenarios (any NPRACH resource utilized by a UE that performs a random access procedure which can correspond to NPRACH format 2 of frame structure type 1, or frame structure type 2 on non-anchor carriers, or mixed operation mode) in case 7 should be captured.  Therefore, the clarification for Rel-15 NPUSCH postponement scenarios in case 7 is not new UE behavior and should be supported.  As for the Rel-14 scenario (NPRACH format 0 or format 1 of frame structure type 1 on non-anchor carriers) in case 7, whether to capture it depends on the Rel-14 modification discussion in Question 1. |
| Nokia, NSB | Yes |

If it is agreed to make a Rel-15 modification on the NPUSCH postponement to capture the missing cases, the following TPs provided by R1- 2107686, R1-2106840, could be considered.

**TP3 in R1-2107686**

**<Unchanged parts are omitted>**

10.1.3.6 Mapping to physical resources

NPUSCH can be mapped to one or more than one resource units, , as given by clause 16.5.1.2 of 3GPP TS 36.213 [4], each of which shall be transmitted  times.

The block of complex-valued symbols  shall be multiplied with the amplitude scaling factor  in order to conform to the transmit power specified in [4], and mapped in sequence starting with  to subcarriers assigned for transmission of NPUSCH. The mapping to resource elements  corresponding to the subcarriers assigned for transmission and not used for transmission of reference signals, shall be in increasing order of first the index , then the index, starting with the first slot in the assigned resource unit.

After mapping to slots, the  slots shall be repeated  additional times, before continuing the mapping of  to the following slot, where





For NPUSCH Format 1 and 2 on frame structure type 2 with ,

- the NPUSCH transmission is carried out in the first set of  slots spanning over two contiguous uplink subframes not overlapping with any uplink subframe configured as invalid;

- for TDD configuration 1 and 4, if the starting position for the NPUSCH is indicated as the second of the two contiguous uplink subframes, the NPUSCH transmission is postponed until the start of two consecutive uplink subframes.

If a mapping to  slots or a repetition of the mapping contains a resource element which overlaps with

- any configured NPRACH resource according to *NPRACH-ParametersList* in *SystemInformationBlockType2-NB*, or

- any configured NPRACH resource according to *nprach-ParametersList* given by *ul-ConfigList* in *SystemInformationBlockType22-NB* and if the UE indicates *multiCarrier-NPRACH* as supported, or

- any configured NPRACH resource according to *nprach-ParametersList* given by *ul-ConfigListMixed* in *SystemInformationBlockType22-NB* and if the UE indicates *multiCarrier-NPRACH and mixedOpeationMode* as supported, or

- any configured NPRACH resource according to *nprach-ParametersListFmt2* in *SystemInformationBlockType2-NB* and if the UE indicates *nprach-Format2* as supported, or

- any configured NPRACH resource according to *nprach-ParametersListFmt2* given by *ul-ConfigList* in *SystemInformationBlockType23-NB* and if the UE indicates *multiCarrier-NPRACH* and *nprach-Format2* as supported, or

- any configured NPRACH resource according to *nprach-ParametersListFmt2* given by *ul-ConfigListMixed* in *SystemInformationBlockType23-NB* and if the UE indicates *multiCarrier-NPRACH* , *mixedOpeationMode* and *nprach-Format2* as supported, or

- any configured NPRACH resource according to *nprach-ParametersListTDD* in *SystemInformationBlockType2-NB*, or

- any configured NPRACH resource according to *nprach-ParametersListTDD* in *SystemInformationBlockType22-NB* and if the UE indicates *multiCarrier-NPRACH* as supported, or

- any configured NPRACH resource configured for Early Data Transmissionand if the NPUSCH transmission is during an Early Data Transmission procedure [12, Clause 7.3b],

then,

- for  the NPUSCH transmission in overlapped slots is postponed until the next  slots not overlapping with any configured NPRACH resource.

- for  the NPUSCH transmission in overlapped  slots is postponed until the next  slots starting with the first slot satisfying and not overlapping with any configured NPRACH resource.

**<Unchanged parts are omitted>**

**TP4 in R1-2106840**

**10.1.3.6 Mapping to physical resources**

**<Unchanged parts are omitted>**

If a mapping to  slots or a repetition of the mapping contains a resource element which overlaps with

- any configured NPRACH resource according to *nprach-ParametersList* in *SystemInformationBlockType2-NB*, or

- any configured NPRACH resource according to *nprach-ParametersList* given by *ul-ConfigList* in *SystemInformationBlockType22-NB* and if the UE indicates *multiCarrier-NPRACH* as supported, or

- any configured NPRACH resource according to *nprach-ParametersList* given by *ul-ConfigListMixed* in *SystemInformationBlockType22-NB* and if the UE indicates *multiCarrier-NPRACH* and *mixedOperationMode* as supported, or

- any configured NPRACH resource according to *nprach-ParametersListFmt2* in *SystemInformationBlockType2-NB* and if the UE indicates *nprach-Format2* as supported, or

- any configured NPRACH resource according to *nprach-ParametersListFmt2* given by *ul-ConfigList* in *SystemInformationBlockType23-NB* and if the UE indicates *multiCarrier-NPRACH* and *nprach-Format2* as supported, or

- any configured NPRACH resource according to *nprach-ParametersListFmt2* given by *ul-ConfigListMixed* in *SystemInformationBlockType23-NB* and if the UE indicates*multiCarrier-NPRACH, mixedOperationMode* and *nprach-Format2* as supported, or

- any configured NPRACH resource according to *nprach-ParametersListTDD* in *SystemInformationBlockType2-NB*, or

- any configured NPRACH resource according to *nprach-ParametersListTDD* in *SystemInformationBlockType22-NB* and if the UE indicates *multiCarrier-NPRACH* as supported, or

- any NPRACH resource utilized by the UE that performs a random access procedure which can correspond to *nprach-ParametersListFmt2*, or *nprach-ParametersList* in *SystemInformationBlockType22-NB,* or *nprach-ParametersListTDD* in *SystemInformationBlockType22-NB,* or

- any configured NPRACH resource configured for Early Data Transmissionand if the NPUSCH transmission is during an Early Data Transmission procedure [12, Clause 7.3b],

then,

- for  the NPUSCH transmission in overlapped slots is postponed until the next  slots not overlapping with any configured NPRACH resource.

- for  the NPUSCH transmission in overlapped  slots is postponed until the next  slots starting with the first slot satisfying and not overlapping with any configured NPRACH resource.

**<Unchanged parts are omitted>**

It is seen that the only difference between TP3 and TP4 is that case 7 is addressed in TP4. Case 1~6 are captured as the same way in both TP3 and TP4, because this is a kind of consensus discussed in last meeting. Therefore, it is suggested to discuss the same part in TP3 and TP4 for case 1~6 and different part in TP4 for case 7 as the starting point if needed.

**Question 5: If a Rel-15 clarification on the NPUSCH postponement to capture the missing cases (1~6) is agreed, do you have any modification on TP3?**

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| **Companies** | **Comments** |
| Ericsson | As we have expressed in previous answers, we are not ok in letting aside case #7. |
| Huawei/HiSilicon | Ok for TP3 |
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**Question 6: If a Rel-15 clarification on the NPUSCH postponement to capture the missing cases (1~7) is agreed, do you have any modification on TP4?**

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| **Companies** | **Comments** |
| Ericsson | If something is to be clarified in RAN1# 106-e, then TP4 is ok as it covers all cases. |
| Lenovo, MotoM | We slightly prefer TP4. |
| Huawei/HiSilicon | We prefer to remove case 7 as commented before. |
| ZTE, Sanechips | We prefer to use TP4 to cover all the cases. It is worth to mention that whether to capture the Rel-14 scenario (NPRACH format 0 or format 1 of frame structure type 1 on non-anchor carriers) in case 7, depends on the Rel-14 modification discussion in Question 1. |
| Nokia, NSB | OK with TP4 |

# Conclusion

To be added

**References**

[1] 3GPP, R1-2106839, Draft Rel-14 CR on Clarification on NPUSCH postponement for NB-IoT, RAN1 #106-e, ZTE, Sanechips

[2] 3GPP, R1-2108119, Clarification on NPUSCH postponement when the NPRACH resource is implicitly indicated, RAN1 #106-e, Ericsson

[3] 3GPP, R1-2106561, Discussion on NPUSCH postponement when overlapping with NPRACH, RAN1 #106-e, Huawei, HiSilicon

[4] 3GPP, R1-2107686, NPUSCH postponement for NB-IoT, RAN1 #106-e, Huawei, HiSilicon

[5] 3GPP, R1-2106840, Draft Rel-15 CR on Clarification on NPUSCH postponement for NB-IoT, ZTE, Sanechips

[6] 3GPP, R1-2106299, Summary of [105-e-LTE-6.1CRs-03] Email discussion/approval on R1-2105398 and R1-2105940, Moderator (ZTE)