**3GPP TSG-RAN WG2 Meeting #109e *R2-2002324***

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

**Agenda item: 5.4.1.4**

**Source: Nokia, Nokia Shanghai Bell**

**Title: Summary of email discussion [AT109e][068][NR15] IODT issue in 1-symbol PUCCH configuration with frequency hopping**

**WID/SID: NR\_newRAT-Core**

**Document for: Discussion and Decision**

# 1 Introduction

Discussion for the following:

R2-2000166 TDoc IODT issue in 1-symbol PUCCH configuration with frequency hopping Nokia, Nokia Shanghai Bell discussion Rel-15 NR\_newRAT-Core

- Wrong AI

- Docomo wonder why FH would be configured for 1 symbol

- CATT think R1 is discussing the same issue this week, so maybe we should wait.

- Nokia think the main problem is the RRC reject which is clearly R2.

- Huawei are not sure ..

- ZTE QC: Have to check

* Continue by email, allow for checking.

R2-2000167 TS 38.331 IODT issue in 1-symbol PUCCH configuration with frequency hopping Nokia, Nokia Shanghai Bell CR Rel-15 38.331 15.8.0 1430 - F NR\_newRAT-Core

* [AT109e][068][NR15] 1-symbol PUCCH with frequency hopping (Nokia)

 Scope: Allow check, Continue treat and discuss the documents R2-2000166, R2-2000167

 Intended outcome: Agreed CRs

 Deadline: Feb 27 1200 CET

# 2 Background

The “pucch-F0-2WithoutFH “capability indicates whether the UE supports transmission of a PUCCH format 0 or 2 without frequency hopping, but the relationship between single-symbol PUCCH and intra-slot frequency hopping in general, and this capability in particular is currently ambiguous..

- When included, the UE does not support PUCCH formats 0 and 2 without frequency hopping.

- When not included, the UE supports the PUCCH formats 0 and 2 without frequency hopping.

When the UE is configured with a single-symbol PUCCH, the specification leaves the following room for interpretation that may lead to IoDT issues:

- Case 1: If the network configures the UE with a single symbol PUCCH resource that includes intra-slot frequency hopping, is that a valid configuration or is the UE allowed to reject such an RRC configuration? There is no functional reason to reject the configuration, but it may appear illogical to include FH configuration with 1-symbol PUCCH.

- Case 2: If the network configures the UE with a single symbol PUCCH resource that does not include intra-slot frequency hopping, is that a valid configuration for the UE not supporting PUCCH format 0/2 without frequency hopping, or is such a UE allowed to reject such an RRC configuration? There is no functional reason to reject the configuration, but it may appear illogical NOT to include FH configuration with the PUCCH configuration when the UE does not support PUCCH format 0/2 without FH.

If both cases would be considered as a valid reason to reject the configuration, the UE not supporting PUCCH format 0/2 would always reject the single-symbol PUCCH configuration – something that the UE is not allowed to do, given that the PUCCH format 0/2 (with FH) is a mandatory feature with no capability indication.

In Table 2-1, the cases marked in GREEN indicate the contradictory behavior from the UE.

|  |  |  |
| --- | --- | --- |
| **UE support for F0/2** | **RRC config includes FH** | **UE rejects RRC config?** |
| With and without FH | Yes | Case 1 reject |
| With and without FH | No | OK |
| With FH only | Yes | Case 1 reject |
| With FH only | No | Case 2 reject |
|  |  |  |
| **Table 2-1: Truth table showing the possible combinations.****Case 1 reject:** Network provided the UE with a FH config with 1-symbol PUCCH, but the UE considers receiving the FH configuration with 1-symbol PUCCH illogical.  |
| **Case 2 reject**: Network did not provide the UE with a FH config but configured 1-symbol PUCCH for UE that does not support F0/F2 w/o FH, but the UE considers not receiving the FH configuration with 1-symbol PUCCH illogical. |

**Observation 1: Looking at Case 1 and Case 2 reject behaviours, network cannot seem to configure 1-symbol PUCCH (even though the specification supports it).**

# 3 Proposal

A specification change to TS 38.331 is needed and illustrated as follows. Note that there are two different changes needed to the TS 38.331 to ensure both Case 1 and Case 2 are covered.



# 4 Discussion

Companies are invited to give their views on Case 1 and Case 2 reject behavior specifically following the description of the issue listed in section 2:

|  |  |
| --- | --- |
| **Company name** | **View on single symbol PUCCH configuration** |
| Nokia, Nokia Shanghai Bell | Single symbol PUCCH configuration is allowed in Rel-15 and the UE should follow proposal 3 above to ensure that both Case 1 and Case 2 reject behavior is avoided. If both cases would be considered as a valid reason to reject the configuration, the UE not supporting PUCCH format 0/2 would always reject the single-symbol PUCCH configuration – something that the UE is not allowed to do, given that the PUCCH format 0/2 (with FH) is a mandatory feature with no capability indication |
| Huawei | In our understanding, Case 1 is because the network configures FH for 1-symbol PUCCH; Case 2 is because the network does not configure FH for the UE that only supports FH. Both scenarios seem to be error configuration.In the 38.331 ASN.1, *intraSlotFrequencyHopping* and *secondHopPRB* are configured in the *PUCCH-Resource*, and each *PUCCH-Resource* is associated with a PUCCH format, i.e. FH related parameters are format-specific rather than common for all formats. Therefore, the network could easily avoid the wrong configuration mentioned above that leads to Case 1 reject or Case 2 reject. |
| MediaTek | The following 2 configurations looks like wrong configurations.• Case 1 - Configure “No FH” for a UE that only supports PUCCH with FH• Case 2 - Configure “1-symbol” + “FH” to a UEFor case 1, the configuration does not match UE capability. For case 2, it seems that FH is not doable if there is only one-symbol PUCCH duration. We usually don’t specify the UE behaviour on mis-configuration, it is possible that the UE may reject the configuration. |
| NEC | There is no case where the intra slot frequency hopping is applied / used for 1 symbol PUCCH format 0/2 based on RAN1 conclusions. From RAN2 (RRC) point of view, simply the network should not configure the *intraSlotFrequencyHopping* for the PUCCH format 0/2 with 1 symbol.  |
| CATT | See our comments in the next table |

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| **Company name** | **Clarification needed in RAN2 (YES/NO)** |
| Nokia, Nokia Shanghai Bell | Yes, reasons as follows * implementation cannot be expected to read chair notes summarizing RAN2 understanding
* in this case it is clear that RAN2 has had a different understanding of the issue before and even thinking that this is a network issue
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| Huawei |  |
| MediaTek | NoWe think that capture in RAN1 chairman Note is enough. If necessary, we could consider to add some clarification in RAN2 Chairman Note. The issue itself is RAN1 feature thus it is nature the companies in RAN2 may have different understanding. There are potentially too much combination on L1 parameters. We don’t think RRC SPEC has to clarify which combination is correct, and which is not.  |
| NEC | Preferably Not as the CR, but acceptable as the remarks in the Chairman notes.This is because as per RAN1 conclusion, even if the network configures the intra slot frequency hopping for PUCCH format 0/2 with 1 symbol, there seems to be no problem from RAN1 specification point of view. Also, the outcome of this set of configuration is not impacted to RAN2 specifications, either.  |
| CATT | In our understanding RAN1’s conclusion is based on a common understanding there that* There was previous RAN1 agreement that intra-slot frequency hopping is only applied for 2-symbol PUCCH format 0 and 2.
* Thus the configuration of FH (or not) has no impact on 1 symbol PUCCH.
* Thus 2 a CR to ran1 spec is not needed.

Based on these we think the case should be clear and we do not see a need for CR to ran2 spec.For the sake of progress we would be OK to have some clarification (but should not contradict to RAN1 understanding) in RAN2 meeting report (although this seems not 100% necessary).  |
| QC | We understand Nokia’s concern and we support their effort in seeking a common understanding among companies.For Case-1: UE should handle this case gracefully (accepting the configuration). For Case-2: Network should be restricted from configuring the UE with such configuration as it’s against the current spec. if configured, UE will invalidate the RRC message.  |
| Samsung | We know that RAN1 also have discussed this issue and they made possible conclusion as below:

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| Possible ConclusionCR in R1-2000553 is not needed, as it is RAN1 common understanding that the presence or absence of the intra-slot frequency hopping configuration (a.k.a intraSlotFrequencyHopping and secondHopPRB) does not have any impact on how the 1-symbol PUCCH is transmitted.l    For UEs supporting PUCCH format 0/2 without intra-slot frequency hopping, intra-slot frequency hopping configuration can be provided but will be ignored for 1-symbol PUCCH.For UEs NOT supporting PUCCH format 0/2 without intra-slot frequency hopping, to avoid possible different interpretations by the UE, 1-symbol PUCCH can still be configured no matter intra-slot frequency hopping configuration is provided or not. |

 We think above RAN1 understanding is quite align with Nokia’s proposal.At the high level, we think there are two approach to clarify this problem: 1) NW restriction that do not configure error case, 2) clarify UE behavior when in-valid configuration is received. Or we just capture some consensus of UE behavior in the minute.In other words, we don’t have strong view whether it is specified on TS or chairman notes. We follows the majority views. |
| NTT DOCOMO | It seems that RAN1 also confirmed that FH configuration is not relevent and does no have any impacts the 1 symbol PUCCH resource. To me, it is enough. On the other hand, if there is a potential IOT problem for the legacy UEs concluded in RAN1 below (i.e. the following two sub-bullets), I'm open to capture it in the spec or RAN2 chair minutes.* For UEs supporting PUCCH format 0/2 without intra-slot frequency hopping, intra-slot frequency hopping configuration can be provided but will be ignored for 1-symbol PUCCH.
* For UEs NOT supporting PUCCH format 0/2 without intra-slot frequency hopping, to avoid possible different interpretations by the UE, 1-symbol PUCCH can still be configured no matter intra-slot frequency hopping configuration is provided or not.
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# 5 Conclusion

Most companies do not see a real need to agree that an update to the RAN2 specs is required. It is enough to capture these in the Chair notes:

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| From RAN2 perspective, we understand from RAN1 discussions that the presence or absence of the intra-slot frequency hopping configuration (a.k.a *intraSlotFrequencyHopping and secondHopPRB*) does not have any impact on how the 1-symbol PUCCH is transmitted.* For UEs supporting PUCCH format 0/2 without intra-slot frequency hopping, intra-slot frequency hopping configuration can be provided but will be ignored for 1-symbol PUCCH.
* For UEs NOT supporting PUCCH format 0/2 without intra-slot frequency hopping, to avoid possible different interpretations by the UE, 1-symbol PUCCH can still be configured no matter intra-slot frequency hopping configuration is provided or not.
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