3GPP TSG-RAN WG2 Meeting #118 Electronic R2-220xxxx

Online, 09 – 20 May 2022

**Agenda item: 6.24.1**

**Source: Huawei, HiSilicon**

**Title: Report of [AT118-e][040][NR17] PUCCH Group (Huawei)**

**Document for: Discussion and Decision**

# 1 Introduction

This document is the report of the following email discussion:

* [AT118-e][040][NR17] PUCCH Group (Huawei)

 Scope: Treat R2-2204443, R2-2205980, R2-2205981, R2-2205982, R2-2205983, R2-2204601, R2-2204600

 Ph1 Determine agreeable parts, Ph2 agree CRs

 Intended outcome: Report, Agreed CRs

 Deadline: Schedule 1

# 2 Contact from companies

|  |  |
| --- | --- |
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# 3 Phase I Discussion

RAN1 sent LS in R2-2204443 to inform RAN2 about the agreements on the new UE capability named as CSI reporting cross PUCCH group. A table of UE capability that reflects all the agreements is given as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (Sidelink WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| Further RRM enhancement for NR and MR-DC | 22-13 | CSI reporting cross PUCCH group | * Support reporting CSI of an SCell belonging to secondary PUCCH group by PUSCH or PUCCH of active serving cells belonging to primary PUCCH group, for both during and after SCell activation procedure.
* Support reporting CSI of an SCell belonging to primary PUCCH group by PUSCH or PUCCH of active serving cells belonging to secondary PUCCH group, for both during and after SCell activation procedure.
* Support for P-CSI and A-CSI for cross-PUCCH group CSI reporting
	+ Indication for UE CSI computation time for A-CSI report = {same as no-cross-PUCCH-group, relaxed}
* Additional indication for support/not of SP-CSI on PUCCH for cross-PUCCH group CSI reporting
* Additional indication for support/not of SP-CSI on PUSCH for cross-PUCCH group CSI reporting
* UE indicates one or multiple supported carrier type pairs(s), each carrier type pair is {carrier type in a PUCCH-group in which CSI measurement is performed, carrier type in the other PUCCH-group in which CSI report is performed}, where a carrier type is one of {FR1 licensed TDD, FR1 unlicensed TDD, FR1 licensed FDD, FR2}
* Note: The UE capability is introduced from Rel-16.
 | FG 2-35 and either FG 6-7 or FG 22-7 | Yes | N/A | Cross-PUCCH group CSI report may not be supported | per BC if the capability is introduced from Rel-16, otherwise per UE. | [No] | [No] | N/A | Note: RAN1 didn’t discuss the potential conflicts with the definition of PUCCH group that was discussed in RAN2 Component 3: if “relaxed” is reported, then indicate additional number of symbols required in addition to existing Z and Z’ for aperiodic CSI report for cross-PUCCH group CSI reporting, which is per SCS (the same SCS set definition as in S5.4 of TS 38.214) reported and has candidate values {val#1, val#2, val#3}.Note: the candidate value {val#1, val#2, val#3} is with range from 14 to 56 symbols only, their exact values are FFS. | Optional with capability signaling |

**3.1 stage 3 CRs**

### TS 38.331 CR

In R2-2205980 (Rel-16 TS 38.331 CR), the Rel-16 UE feature group named as *csiReportingCrossPUCCHGrp* is added in *CA-ParametersNR*. According to the RAN1 agreements, the component #1, #2 and #3 are supported by default if UE indicating the support of this feature group, thus no explicit UE capability reporting signalling is needed to indicate the support of the three components. For component #3,one additional indication of computation time for A-CSI report is to be reported, furthermore, the component #4, #5, #6 also require the explicit indications, thus the following capabilities are proposed to be reported:

1. computationTimeForA-CSI-r16 (computation time for A-CSI report for component #3)
2. sp-CSI-ReportingOnPUCCH-r16 (component #4)
3. sp-CSI-ReportingOnPUSCH-r16 (component #5)
4. carrierTypePairList-r16 (component #6)

CA-ParametersNR-v16xx ::= SEQUENCE {

 csiReportingCrossPUCCHGrp-r16 SEQUENCE {

 computationTimeForA-CSI-r16 ENUMERATED {sameAsNoCross, relaxed},

 sp-CSI-ReportingOnPUCCH-r16 ENUMERATED {supported} OPTIONAL,

 sp-CSI-ReportingOnPUSCH-r16 ENUMERATED {supported} OPTIONAL,

 carrierTypePairList-r16 SEQUENCE (SIZE (1..maxCarrierTypePairList-r16)) OF CarrierTypePair-r16

 } OPTIONAL

}

**Q1: Do companies agree the above signalling of UE capability reporting for the RAN1 agreed UE capability of CSI reporting cross PUCCH group?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| Apple | Agree |  |
| MediaTek | Agree with comments | 1. According to past(relevant) ASN.1 naming convention adopted in CSI Reporting, it's better to use *csi-ReportingCrossPUCCH-Grp-r16* or something like this to keep style consistently.
2. The ASN.1 IE implementation of “BandCombination-UplinkTxSwitch-v16xx” is incorrect, it shall be a SEQUENCE of “BandCombination-v16xx”.
 |
| Intel | Agree, with comments | As indicated in Q3, the component 3 is with 3 values if it is set to ‘relaxed’.  There is a need to indicate the 3 values as ENUMERATED {val1, val2, val3} and it can be left to RAN1 to specify the values represented in their specification. |
| Samsung | Agree | Agree with MediaTek that naming should be updated (i.e., acronym is followed by dash). |
| Vivo | Agree |  |
| Ericsson | Agree | We also share the same view as Intel |
| ZTE | Agree | Agree with MediaTek that the naming can be updated. |
| Nokia | Agree with comments | Agree with Intel we should have the placeholder for the values. |
| CATT | Agree | Agree with MediaTek. |
| Huawei, HiSilicon | Agree | The value of additional computation time mentioned by intel is under-discussion in Q3.We accept the suggestion from MediaTek on the naming.To clarify, this capability is suggested to be added in CA-ParametersNR, which can be reported in both of legacy BC list and UL Tx switching BC list as other CA specific capabilities. |

In details, the *CarrierTypePair* can reuse the Rel-16 type named as *PUCCH-Grp-CarrierTypes* (introduced for *TwoPUCCH-Grp-ConfigParams*) to indicate one or multiple supported carrier type pairs(s) of {carrier type in a PUCCH-group in which CSI measurement is performed, carrier type in the other PUCCH-group in which CSI report is performed} as below.

CarrierTypePair-r16 ::= SEQUENCE {

 carrierForCSI-Measurement-r16 PUCCH-Grp-CarrierTypes-r16,

 carrierForCSI-Reporting-r16 PUCCH-Grp-CarrierTypes-r16

}

The existing Rel-16 UE capability of *PUCCH-Grp-CarrierTypes*:

PUCCH-Grp-CarrierTypes-r16 ::= SEQUENCE {

 fr1-NonSharedTDD-r16 ENUMERATED {supported} OPTIONAL,

 fr1-SharedTDD-r16 ENUMERATED {supported} OPTIONAL,

 fr1-NonSharedFDD-r16 ENUMERATED {supported} OPTIONAL,

 fr2-r16 ENUMERATED {supported} OPTIONAL

}

**Q2: Do companies agree the above signalling of UE capability reporting for the supported carrier type pairs(s) of {carrier type in a PUCCH-group in which CSI measurement is performed, carrier type in the other PUCCH-group in which CSI report is performed}?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| Apple | Agree |  |
| MediaTek | Agree |  |
| Intel | Agree |  |
| Samsung | Agree |  |
| Vivo | Agree |  |
| Ericsson | Agree |  |
| ZTE | Agree but | For the maximum number of supported carrier type pair (maxCarrierTypePairList-r16), it seems that the value 16 (not 32) is enough considering at most four types are supported for each carrier. |
| Nokia | Agree |  |
| CATT | Agree |  |
| Huawei, HiSilicon | Agree | Agree with ZTE’s comment, 16 is enough for the maximum number of carrier type. |

In the Note column, RAN1 indicates for component 3: if “relaxed” is reported, then indicate additional number of symbols required in addition to existing Z and Z’ for aperiodic CSI report for cross-PUCCH group CSI reporting, which is per SCS (the same SCS set definition as in S5.4 of TS 38.214) reported. The candidate value {val#1, val#2, val#3} is with range from 14 to 56 symbols only, the exact values are FFS and is to be settled in this RAN1 meeting. Then in RAN2 there are two options to handle this FFS point in this meeting:

* Option1: Not capture it for now, wait for RAN1 conclusion on the value;
* Option2: Capture it in the CRs, and leave the exact value as FFS.

It seems not urgent to capture is now, thus the moderator suggests to wait for RAN1 conclusion.

**Q3: For the additional symbol number in case of relaxed computation time for A-CSI report, do companies agree that RAN2 does not discuss the signalling in this meeting and wait for RAN1 conclusion on the exact value?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| Apple | Agree to wait for RAN1 |  |
| MediaTek | Agree | Wait for RAN1 (i.e. Option 1) |
| Intel | Option 2 with comment | But the exact values to be specified by RAN1 specification. Otherwise, the whole signalling should be postponed since it is not complete? |
| Samsung | Option 2 | Agree with Intel. |
| vivo | Agree to wait for RAN1 |  |
| Ericsson | Wait for RAN1 |  |
| ZTE | Agree to wait for RAN1 |  |
| Nokia | Option 2 | Agree with Intel |
| CATT | Agree to option 1 |  |
| Huawei, HiSilicon | Agree | Slightly prefer waiting for RAN1, but we are ok to discuss and include the additional computation time in phase II CR discussion. [Seems RAN1 is having good progress on the value conclusion so far.] |

### TS 36.306 CR

In R2-2205982 (Rel-16 TS 38.306 CR), the definitions for the Rel-16 UE feature group of *csiReportingCrossPUCCHGrp* is provided as below.

| ***csiReportingCrossPUCCHGrp-r16***Indicates the support of CSI reporting cross PUCCH group, including:* support reporting CSI of an SCell belonging to secondary PUCCH group by PUSCH or PUCCH of active serving cells belonging to primary PUCCH group, for both during and after SCell activation procedure;
* support reporting CSI of an SCell belonging to primary PUCCH group by PUSCH or PUCCH of active serving cells belonging to secondary PUCCH group, for both during and after SCell activation procedure;
* support for P-CSI and A-CSI for cross-PUCCH group CSI reporting;
* computationTimeForA-CSI-r16 indicates the CSI computation time for A-CSI;
* sp-CSI-ReportingOnPUCCH-r16 indicates whether the UE supports SP-CSI reporting on PUCCH for cross-PUCCH group CSI reporting;
* sp-CSI-ReportingOnPUSCH-r16 indicates whether the UE supports SP-CSI reporting on PUSCH for cross-PUCCH group CSI reporting;
* carrierTypePairList-r16 indicates one or multiple supported carrier type pairs(s). For each supported carrier type pair :
	+ *carrierForCSI-Measurement-r16* indicates the carrier type in a PUCCH group in which CSI measurement is performed ;
	+ *carrierForCSI-Reporting-r16* indicates the carrier type in the other PUCCH-group in which CSI report is performed},
	+ where a carrier type is one of {FR1 licensed TDD, FR1 unlicensed TDD, FR1 licensed FDD, FR2}

UE indicating support of this feature shall indicate *csi-ReportFramework* and indicate support of either *twoPUCCH-Group* or *twoPUCCH-Grp-ConfigurationsList-r16.*NOTE 1: For a band combination with SUL, the SUL band is counted as one of the bands.NOTE 2: For a band combination with SDL, the SDL band is counted as one of the bands. SDL is indicated as 'FR1-NonSharedFDD' carrier type. Per UE capabilities that are TDD only are not applicable to SDL.NOTE 3: When the carrier type of NUL is indicated for PUCCH/PUSCH transmission location for CSI measurement or CSI reporting, the SUL in the same cell as in the NUL can also be configured for PUCCH/PUSCH transmission. | BC | No | N/A | N/A |
| --- | --- | --- | --- | --- |

**Q4: Do companies agree the above definitions for the Rel-16 UE feature group of *csiReportingCrossPUCCHGrp* and its components?**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| Intel | Agree, with comment | Need to indicate that the component 3 when set to relaxed has 3 values that can be supported by UE.  |
| Samsung | Agree |  |
| vivo | Agree |  |
| Ericsson | Agree |  |
| ZTE | Agree  |  |
| MediaTek | Agree with comments | Naming shall be aligned with final ASN.1 implementation in Q1. |
| Nokia | Agree | Agree with Intel |
| CATT | Agree |  |
| Huawei, HiSilicon | Agree | Open to discuss the signalling and description of computation time in phase II discussion. |
|  |  |  |

**3.2 Stage 2 CR**

### TS 38.300 CR

In R2-2204601, it propose to introduce definition of primary PUCCH group and secondary PUCCH group in 38.300 as following:

**Primary PUCCH group: a group of serving cells including SPCell whose PUCCH signalling is associated with the PUCCH on SPCell except for CSI report**

**Secondary PUCCH group: a group of SCells whose PUCCH signalling is associated with the PUCCH on the PUCCH SCell except for CSI report.**

**Q5: Do companies agree to add above definitions of primary PUCCH group and secondary PUCCH group in TS 38.300?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| Intel | No strong view | According to RAN1 reply LS, the cross-PUCCH group CSI reporting is supported. If the definition of primary/secondary PUCCH group is introduced, we also need to clarify how to understand “except for CSI report”, so it seems the description of cross-PUCCH group CSI reporting is also needed in spec.  |
| Samsung | - | In general, this type of changes should be discussed and endorsed in RAN1 first, and then sent to RAN2 by LS for agreement, as RAN2 did for RAN3-related changes in TS 38.300. |
| vivo | Agree  | The definitions in 38300 are needed. And the proposed above looks reasonable.  |
| Ericsson | Prefer not to have this for the moment | We are not completely against of having the definitions in stage 2, but we would like to wait for RAN1 to completely finish this and then, once that we have overall picture, we can decide how to capture in stage2. |
| ZTE | - | Agree with the intention. But as Samsung’s comment, whether we need to ask RAN1 to discuss and clarify the definition firstly? |
| MediaTek | See comments | The part on “**except for CSI report**” is confusing and we prefer not to mention it (i.e. such a detail could be skipped) in stage 2 specification. We can figure out a way to have it refers to stage 3 specification if it’s really necessary. |
| Nokia | Disagree | The group and association are as configured by RRC. The PUCCH group definition is not changed even though CSI can be reported cross group. No problem with leaving the definition out since it is already clear in other part of descriptions in 38.300 and stage 3 specifications. |
| CATT | Agree | Agree with the intention and the proposed definition is reasonable, we could update it if RAN1 find the issue on this definition. |
| Huawei, HiSilicon | No strong view | The definition itself is correct. But without the definition, there is nothing wrong as the UE will have proper behaviour following RRC configuration. We could follow majority view. |
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**3.3 Any other issues?**

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| **Company** | **Comments** |
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# 4 Phase II Discussion on CR details

# 5 Conclusion

# 6 Reference

1. R2-2204443 Reply LS on beam information of PUCCH SCell in PUCCH SCell activation procedure (R1-2202778; contact: Huawei) RAN1 LS in Rel-17 NR\_RRM\_enh2-Core To:RAN2, RAN4
2. R2-2205980 Adding UE capability of CSI reporting cross PUCCH SCell group Huawei, HiSilicon CR Rel-16 38.331 16.8.0 3143 - B NR\_RRM\_enh2-Core
3. R2-2205981 Adding UE capability of CSI reporting cross PUCCH SCell group Huawei, HiSilicon CR Rel-17 38.331 17.0.0 3144 - A NR\_RRM\_enh2-Core
4. R2-2205982 Adding UE capability of CSI reporting cross PUCCH SCell group Huawei, HiSilicon CR Rel-16 38.306 16.8.0 0730 - B NR\_RRM\_enh2-Core
5. R2-2205983 Adding UE capability of CSI reporting cross PUCCH SCell group Huawei, HiSilicon CR Rel-17 38.306 17.0.0 0731 - A NR\_RRM\_enh2-Core
6. R2-2204601 Discusson on concept of PUCCH group OPPO discussion Rel-16 NR\_RRM\_enh2-Core R2-2202450
7. R2-2204600 CR to Clarification of PUCCH group definition OPPO CR Rel-16 38.300 16.8.0 0442 - F NR\_RRM\_enh2-Core