3GPP TSG-RAN WG1 Meeting #100bis-e R1-20xxxxx

e-Meeting, 20th – 30th April, 2020

Agenda Item: 7.2.2.1.3

Source: Moderator (Ericsson)

Title: FL Summary for [100b-e-NR-unlic-NRU-ULSignalsChannels-03] Email discussion/approval

Document for: Discussion, Decision

# 1 Introduction

Based on the conclusion of the e-meeting preparation phase [21] and the vice-Chairman’s guidance, the following e-mail discussion has been kicked-off:

[100b-e-NR-unlic-NRU-ULSignalsChannels-03] Email discussion/approval on the following issues

by 4/22; if necessary, followed by endorsing the corresponding TPs by 4/28 – Steve (Ericsson)

* Rule for interlaced PUCCH allocation for a carrier without guard bands
* Editorial (but critical) corrections on PUCCH

The following topics are included in this email discussion

|  |  |  |  |
| --- | --- | --- | --- |
| **Issue** | **Description** | **Tdoc References** | **Class** |
| 10 | Rule for PUCCH allocation for a carrier without intra-cell guardbands (single RB set) when interlaced PUCCH is configured, e.g., lowest 10 RBs of the first, and if configured, second interlace.TP needed to 38.213 §9.2.1 | R1-2002382: P8 | Critical |
| 6 | Correction for multiplexing of coded UCI bits to PUCCH for PUCCH Format 3 considering spreading factor $N\_{SF}^{PUCCH,3}$TP needed to 38.212 §6.3.1.6 | R1-2001651: P4 | Critical(but simple editorial fix) |
| 5 | Clarification on the conditions for using PUCCH Format 0,1,2,3,4 for UCI transmissionSimple TP needed to 38.213 §9.2.2 | R1-2002192: I1 | Critical(but simple editorial fix) |
| 7 | Alignment of RRC parameters between 38.331 and RAN1 specs. RAN2 has consolidated the number of parameters configuring interlaced transmission. The 2 new parameters are:* *useInterlacePUCCH-PUSCH* within the BWP-UplinkCommon IE
* *useInterlacePUCCH-PUSCH* within the BWP-UplinkDedicated IE

which replace the 4 old parameters:* *useInterlacePUCCH-Common*
* *useInterlacePUSCH-Common*
* *useInterlacePUCCH-Dedicated*
* *useInterlacePUSCH-Dedicated*

TPs needed to 38.211, 212, 213, 214 in multiple sections. | R1-2002030: P7R1-2001704: P3 | Editorial |

# 2 Discussion

## 2.1 Issue #10: PUCCH Allocation for Carrier Without Intra-Cell Guard Bands

**Description**:

In 38.213 Section 9.2.1, it is described how the parameters *interlace0*, *interlace1* (if provided), and *rb-SetIndex* together determine the RBs occupied by a PUCCH resource in a BWP. For a 20 MHz carrier or for a wideband (> 20 MHz) carrier with intra-cell guard bands, the parameter *rb-SetIndex* indicates in which RB set the PUCCH resource is allocated. This is consistent with the first agreement below which says that a PUCCH resource is confined to a 20 MHz carrier/LBT bandwidth. However, for a wideband carrier without intra-cell guard bands where there is only a single RB set, it is not clear on what should be the frequency domain resource allocation for the PUCCH resource. Which 20 MHz LBT bandwidth should the PUCCH resource occupy?

A simple rule is needed for this, and one option is to simply specify that the lowest indexed RBs of the configured interlace(s) should be used for PUCCH.

Agreement:

A bandwidth occupied by a PUCCH resource does not exceed the bandwidth corresponding to a 20 MHz carrier/LBT bandwidth

Agreement:

* The RRC parameters *intraCellGuardBandDL-r16* and *intraCellGuardBandUL-r16* include a mechanism to indicate that no intra-carrier guard-bands are configured
	+ Note: This configuration may be used for the case where transmission only occurs in a BWP if LBT is successful in all RB sets within the BWP
* For a carrier with intra-carrier guard bands, the UE does not expect that the dedicated BWP is configured to include parts of a RB set.

**Affected Specification(s)**:

* 38.213 Section 9.2.1

**Alternatives:**

* Alt-1: For a wideband (>20 MHz) carrier without intra-cell guard bands, the 10/11 lowest indexed RBs of the indicated interlace(s) are used for PUCCH transmission

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| --- | --- |
| **Company** | **View/Position** |
| ZTE | Fine with the proposal |
| NTT DOCOMO | Support Alt-1 and OK with TP#1 |
| Huawei | The value of $M\_{interlace,0}^{PUCCH}$ and $M\_{interlace,1}^{PUCCH}$ should also be limited to 10/11 when no intra-cell guardbands are configured.  \*\*\* Unchanged text omitted \*\*\*If a UE is provided *~~useInterlacePUCCH-Dedicated-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated*, the UE determines available RBs for PUCCH transmissions within the BWP as the intersection of RBs corresponding to an interlace index provided by *interlace0* and, if provided, *interlace1*, and RBs of an RB set provided by *rb-SetIndex*. The intersection results in $M\_{interlace,0}^{PUCCH}$ RBs in the first interlace. If *interlace1* is provided, the intersection results in $M\_{interlace,1}^{PUCCH}$ RBs. If the BWP corresponds to an UL carrier without intra-cell guard bands, the UE assumes that the $M\_{interlace,0}^{PUCCH}$ and, if applicable, $M\_{interlace,1}^{PUCCH}$ lowest indexed RBs of the respective interlace(s) within the BWP are used for PUCCH transmission. UE expects that $M\_{interlace,0}^{PUCCH}$ is either 10 or 11. UE expects that $M\_{interlace,1}^{PUCCH}$, if any, is either 10 or 11. |
| Nokia, NSB | We are in principle ok with the proposal. However we also need to clarify in the TP the exact number of PRBs for PUCCH ($M\_{interlace,0}^{PUCCH} and M\_{interlace,1}^{PUCCH}$) in this case. In the normal case these are determined based on RB sets and are equal to 10 or 11, but without RB sets, the numbers can be fixed to 10.  |
| Sharp | Support , and we have similar view as Nokia, NSB. For the TP, how to determine $M\_{interlace,0}^{PUCCH}$ or $M\_{interlace,1}^{PUCCH}$ may be complicated since there is no intra-cell guard bands. We slightly prefer the UE assume $M\_{interlace,0}^{PUCCH}=10$, and $M\_{interlace,1}^{PUCCH}$ = 10, if any. |
| LG Electronics | Prefer to wait for the outcome of the relevant discussion on the case with no guard band under WB agenda. |
| Lenovo, Motorola Mobility | Agree with the proposal. |
| MediaTek | Share similar view with LGE |
| Samsung  | Agree with FL’s proposal.  |
| Qualcomm | For wider band LBT with zero guard, we don’t see a problem with crofCRBs-r16 set to 0, and the RB sets are defined normally. Then same RB set index mechanism can be used with and without guardband, and the previous agreement of using the first 10 or 11 applies with no spec change. |
| Intel | Share similar view with LGE. The proposal depends on the conclusion of one of the WB agenda topics. |
| OPPO | Agree with Qualcomm |
| vivo | Share the same with LGE and MediaTek to wait the outcome under WB agenda. From our understanding, one RB set corresponds to 20MHz, regardless of intra-cell guard bands are configured or not. |
| Spreadtrum | Share the same view with LGE. |

1. Adopt Alt-1 above and the following TP

-------------------------------------- Text Proposal (TP#1) for 38.213, Section 9.2.1 ---------------------------------

\*\*\* Unchanged text omitted \*\*\*

If a UE is provided *~~useInterlacePUCCH-Dedicated-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated*, the UE determines available RBs for PUCCH transmissions within the BWP as the intersection of RBs corresponding to an interlace index provided by *interlace0* and, if provided, *interlace1*, and RBs of an RB set provided by *rb-SetIndex*. The intersection results in $M\_{interlace,0}^{PUCCH}$ RBs in the first interlace and the UE expects that $M\_{interlace,0}^{PUCCH}$ is either 10 or 11. If *interlace1* is provided, the intersection results in $M\_{interlace,1}^{PUCCH}$ RBs in the second interlace and the UE expects that $M\_{interlace,1}^{PUCCH}$ is either 10 or 11. If the BWP corresponds to an UL carrier without intra-cell guard bands, the UE assumes that the $M\_{interlace,0}^{PUCCH}$ and, if applicable, $M\_{interlace,1}^{PUCCH}$ lowest indexed RBs of the respective interlace(s) within the BWP are used for PUCCH transmission.

\*\*\* Unchanged text omitted \*\*\*

------------------------------------------------------ End Text Proposal -------------------------------------------------------

### 2.1.1 Summary of Discussion

* 7 companies support TP#1
	+ 3 of these companies suggest minor modifictions to the TP which can be accommodated easily
* 5 companies prefer to wait for the outcome of Email Thread #1 in the Wideband Operation Agenda Item which has the same deadlines as this thread
	+ However, it is not clear what the dependence is. It is the FL’s understanding that the question is not whether or not a carrier with no guard bands should be supported (RAN1 already agreed to that), but rather how the RB Set/Guard Band indexing should work for such a carrier. TP#1 is not dependent on that since it simply says “for an UL carrier without intra-cell guard bands”

Hence, the FL recommendation is as follows:

1. FL to update TP#1 according to company feedback. Further discuss updated TP#1 until 4/28.

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| **Company** | **View/Position** |
| Sharp | We support TP#1.We agree to the FL’s understanding that the question is not whether or not a carrier with no guard bands should be supported. TP#1 provides a simple solution for resource allocation of a PUCCH in a case where no intra-cell guard bands are configured. The proposed method is already implemented for a PUCCH format 3 as in TS38.213V16.1.0.TS38.213V16.1.0 (2020-03)9.2.1 PUCCH Resource Sets…If the *format* indicates *PUCCH-format3-r16*, the UE assumes that the $M\_{RB}^{PUCCH,3}$ [4, TS38.211] PRBs with the lowest indexes within the first, and if configured, second interlace are used for PUCCH transmission. |
| LG Electronics | On the updated proposals, we have several comments/concerns as below.- Finally, regarding to no guard-band issue, even in wideband agenda, there is no explicit agreement that the BWP configured with no guard-band is defined as single RB set. On top of that, according to the following agreement in RAN1#99, the RB set is defined to be corresponding to the LBT BW.- Therefore, even if the UL BWP is configured with no guard band, it would be possible to operate with multiple RB sets based on a certain rule (for example, by assuming the guard band locations defined in RAN4 specification as RB set boundary, or divide the UL BWP equally).- If the UL BWP configured with no guard band but containing multiple LBT BWs, is defined as single RB set, and if the PUCCH is enforced to be allocated into lowest RBs, the PUCCH transmission will be concentrated on a certain region (e.g., in lowest frequency region) of the BWP, and then not only the overhead to be reserved for LBT gaps between multiple UEs would be increased, but also the LBT success rate would be decreased.- Moreover, if the PUCCH is enforced to be allocated into lowest RBs, the interlace resources (indexes) available for PUSCH transmission/scheduling would be largely restricted since the interlace(s) allocated for PUCCH cannot assigned for PUSCH, even though the residual RBs of the interlace(s) (e.g., in highest frequency region) are available to use. (On the other hand, if the PUCCH can be allocated across the BWP, the restriction on the interlaces available for PUSCH would be mitigated.) |
| Sharp | Comment to LG,TP#1 doesn’t say anything about RB-set. The proposal is to say that PUCCH is allocated to lower frequency portion within the UL BWP. Thus, it doesn’t touch the RB-set definition.Mapping between LBT BW and RB-set can be revisited after we decided on RB-set definition for a carrier with no intra-cell guard bands.As currently discussed in wideband operation AI, the BWP size can be smaller than the carrier. So, if UE#0’s PUCCH resource is in the lower frequency portion, the other UE (UE#1) can be configured with a BWP avoiding the PUCCH resource for UE#0. |
| LG Electronics | According to Sharp’s comment and figure, the PUCCH for UE #1 could be allocated in second RB set. If it is correct, it is inefficient and undesirable that the different BWPs are configured for each UE in order to control the load balancing of PUCCH resources. |

### 2.1.2 Options for Realizing an UL Carrier Without Guard Bands

Based on some of the comments from companies in the previous section (see LG and Sharp comments) we need to discuss an intermediate issue before finalizing the TP#1. The issue is how an UL carrier without guardbands will be realized. This issue also impacts Email Thread #1 and Email Thread #2.

To focus the discussion, I drafted a PowerPoint slide and put it in the drafts folder:

<https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Inbox/drafts/7.2.2.1.3%20UL%20signals%20and%20channels/Thread-03/UL%20Carrier%20Without%20Guard%20Bands.pptx>

Here is a copy of the diagram:



This illustrates two options for how an UL carrier without guard bands could be realized, and they have different consequences on PUCCH/PUSCH resource allocation. Clearly Option 2 has far less (no?) spec impact – we can reuse all existing resource allocation mechanisms for PUCCH/PUSCH for both wideband and 20 MHz carriers. However, I realize that a decision would need to be made in the Wideband Operation agenda item, but there is not harm in discussing the options here. It would be useful input to the discussion in the wideband agenda item on how the choice impacts PUCCH/PUSCH resource allocation.

If one of these options can be agreed next week, we can adjust TP#1. If Option 1 was agreed, then the TP#1 is needed, since a rule is needed on where within the BWP the PUCCH resource is located. However, if Option 2 was agreed, we wouldn’t need the TP#1 at all since the RRC parameter *rb-SetIndex* would control in which RB set the PUCCH resource is allocated.

The FL recommendation is that Option 2 is much cleaner and unifies the solutions between carriers with and without guardbands. It also works for 20 MHz carriers in which case there would only be one RB set with index 0. This would also make the discussions in Email Thread #1 and #2 easier.

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| **Company** | **View/Position** |
| Ericsson | Option 2This option is more flexible and can reuse existing signaling (DCI and RRC) for PUCCH/PUSCH resource allocation |
| LG Electronics | Option 2 is strongly preferred since it is quite aligned with our considerations. |
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## 2.2 Issue #6: Multiplexing of Coded UCI Bits to Interlaced PUCCH Format 3

**Description**:

In Section 6.3.1.6 of 38.212, the mapping of coded UCI bits to PUCCH is specified; however, the number of UCI symbols does not take into account the newly introduced spreading factor (OCC) for interlaced PUCCH format 3.

**Affected Specification(s)**:

* 38.212 Section 6.3.1.6

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| --- | --- |
| **Company** | **View/Position** |
| ZTE | Agree with the proposal |
| NTT DOCOMO | OK with TP#2 |
| Huawei | Agree with the TP. |
| Nokia, NSB,  | Agree with the TP |
| Sharp | Agree with the TP |
| LG Electronics | Agree with the TP#2 |
| Lenovo, Motorola Mobility | Agree with the TP. |
| MediaTek | Agree with the TP |
| Samsung | Agree with the TP |
| Qualcomm | Agree with the TP |
| Intel | Agree with the TP |
| OPPO | OK |
| vivo | Agree with TP#2 |
| Spreadtrum | Agree with the TP |

--------------------------------- Text Proposal (TP#2) for 38.212, Section 6.3.1.6 ------------------------------------

\*\*\* Unchanged text omitted \*\*\*

Denote  as UCI OFDM symbol index. Denote  as the number of elements in UCI symbol indices set  for , where  and  are given by Table 6.3.1.6-1 according to the PUCCH duration and the PUCCH DMRS configuration. Denote  as the number of OFDM symbols carrying UCI in the PUCCH. Denote  as the modulation order of the PUCCH.

For PUCCH format 3, set $N\_{UCI}^{symbol}=12⋅N\_{PRB}^{PUCCH,3}$ $N\_{UCI}^{symbol}=12⋅N\_{PRB}^{PUCCH,3}/N\_{SF}^{PUCCH,3}$, where  is the number of PRBs that is determined by the UE for PUCCH format 3 transmission according to Clause 9.2 of [5, TS 38.213], and $N\_{SF}^{PUCCH,3}$ is the spreading factor for PUCCH format 3 [4, TS 28.111].

For PUCCH format 4, set , where  is the spreading factor for PUCCH format 4.

\*\*\* Unchanged text omitted \*\*\*

------------------------------------------------------ End Text Proposal -------------------------------------------------------

### 2.2.1 Summary of Discussion

There is consensus to support TP#2. The FL recommendation is as follows:

1. Support TP#2 for 38.212 Section 6.3.1.6

## 2.3 Issue #5: Conditions for using PUCCH different PUCCH Formats for UCI transmission

**Description**:

At the beginning of Section 9.2.2 of 38.213, there is a list of conditions under which PF 0, 1, 2, 3, and 4 are configured depending on the PUCCH length (≤2 vs. ≥4), number of UCI bits (≤2 vs. >2), and whether or not an OCC is onfigured. For Rel-16, interlacing is another condition that is added. In addition OCCs can now be configured for PF2/3. The current text does not capture the various conditions accurately, and needs to be updated. In addition the RRC parameter names for configuring interlacing need to be aligned with the new parameter names decided by RAN2 (Issue #7).

**Affected Specification(s)**:

* 38.213 Section 9.2.2

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| **Company** | **View/Position** |
| ZTE | The TP may not be needed, as the following description for the parameter *OCC-Length-r16* and *OCC-Index-r16* in 331 seems to be sufficient.“Applicable when useInterlacePUCCH-Dedicated-r16 is configured as ‘enable.’When configured, use OCC of 2 or 4 for interlaced PF2/3.” |
| NTT DOCOMO | OK with TP#3 |
| Huawei | Share same view as ZTE. The conditions for using different PUCCH formats are clear enough. We think this TP is not necessary. |
| Nokia, NSB | Support the TP. The conditions for selecting the PUCCH format are not as clear as they could be. To avoid risk of any confiusion, it is best to clarify the conditions as proposed.* the condition related to OCC for PF2 is not needed
* the condition related to OCC for PF3 is confusing when read together with PF4. Note that now in Rel-16 both PF3 and PF4 satisfy the conditions that were earlier set for PF4 only. The way it currently reads, nothing prevents the UE from selecting PF4 when *OCC-Length-r16* is configured.
 |
| LG Electronics | Agree with the TP#3. |
| Lenovo, Motorola Mobility | Agree with TP#3. |
| MediaTek | Agree with the TP |
| Samsung | Agree with the TP |
| Qualcomm | Agree with the TP |
| Intel | Agree with the TP |
| vivo | Agree with TP#3. |
| Spreadtrum | Agree with the TP |

--------------------------------------- Text Proposal (TP#3) for 38.213, Section 9.2.2 --------------------------------

\*\*\* Unchanged text omitted \*\*\*

9.2.2 PUCCH Formats for UCI transmission

If a UE is not transmitting PUSCH, and the UE is transmitting UCI, the UE transmits UCI in a PUCCH using

- PUCCH format 0 if

- the transmission is over 1 symbol or 2 symbols,

- the number of HARQ-ACK information bits with positive or negative SR (HARQ-ACK/SR bits) is 1 or 2

- PUCCH format 1 if

- the transmission is over 4 or more symbols,

- the number of HARQ-ACK/SR bits is 1 or 2

- PUCCH format 2 if

- the transmission is over 1 symbol or 2 symbols,

- the number of UCI bits is more than 2

~~- the PUCCH resource includes an orthogonal cover code if the UE is provided an orthogonal cover code length by~~ *~~OCC-Length-r16~~* ~~and index by~~ *~~OCC-Index-r16~~*

- PUCCH format 3 if

- the transmission is over 4 or more symbols,

- the number of UCI bits is more than 2,

- the PUCCH resource does not include an orthogonal cover code or the UE is provided *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated*

~~- the PUCCH resource includes an orthogonal cover code if the UE is provided an orthogonal cover code length by~~ *~~OCC-Length-r16~~* ~~and index by~~ *~~OCC-Index-r16~~*

- PUCCH format 4 if

- the transmission is over 4 or more symbols,

- the number of UCI bits is more than 2,

- the PUCCH resource includes an orthogonal cover code and the UE is not provided *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated*

\*\*\* Unchanged text omitted \*\*\*

------------------------------------------------------ End Text Proposal -------------------------------------------------------

### 2.3.1 Summary of Discssuion

10 companies agree to TP#3 while 2 companies suggest that it may not be needed. Given that it appears there is no strong objection to the TP, the FL recommendation is as follows:

1. Support TP#3 for 38.213 Section 9.2.2

## 2.4 Issue #7: Alignment of RRC parameters between 38.331 and RAN1 specs

**Description**:

In current RAN1 specs (38.211, 212, 213, 214) there are multiple references to separate parameters for for configuring interlaced transmission for PUSCH and PUCCH both before and after dedicated configuration:

* For PUCCH and PUSCH transmissions prior to dedicated configuration:
	+ *useInterlacePUCCH-Common*
	+ *useInterlacePUSCH-Common*
* For PUCCH and PUSCH transmissions after dedicated configuration:
	+ *useInterlacePUCCH-Dedicated*
	+ *useInterlacePUSCH-Dedicated*

In 38.213 and 38.214 there is currently text that says that the UE expects that the parameters are configured in a common way. In other words, it is not allowed to configure interlacing differently for PUSCH and PUCCH, and it is not allowed to have interlacing configured differently before and after dedicated configuration.

For this reason, in RAN2 there was an agreement to consolidate these parameters. In the most recent version of 38.33, the above four parameters have been replaced by the following two parameters:

* *useInterlacePUCCH-PUSCH* within the BWP-UplinkCommon IE
	+ This parameter is used to configure interlacing for both PUCCH and PUSCH prior to dedicated configuration on a PCell
	+ This is conveyed to the UE in SIB1
* *useInterlacePUCCH-PUSCH* within the BWP-UplinkDedicated IE
	+ This parameter is used to configure interlacing for both PUCCH and PUSCH after dedicated configuration for SCell addition
	+ This is conveyed to the UE via dedicated signalling

These changes in 38.331 now need to be reflected in all RAN1 specs (38.211, 212, 213, and 214) that currently refer to the old parameters.

**Affected Specification(s)**:

* 38.211 Section 6.3.2.2.2
* 38.212 Sections 7.3.1.1.1, 7.3.1.1.2
* 38.213 Sections 8.1.A, 8.3, 9.2.1
* 38.214 Sections 6.1.2.2, 6.1.2.3

In the following table, please provide your view on the below editorial TPs.

One further issue is that the above mentioned RAN2 agreement seems to have overridden a RAN1 understanding that an interlace configuration is a property of a serving cell, not of a BWP. Hence please also provide your view on the following question (yes/no):

Q1: “Shall the UE expect that *useInterlacePUCCH-PUSCH* is configured the same way for all BWPs of a serving cell?”

If consensus is achieved on this question, the FL can draft an additional TP later to capture this, e.g., a TP for 38.213 Section 12.

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| **Company** | **View/Position** |
| ZTE | Agree with the alignment of the parameters.Yes to Q1. |
| NTT DOCOMO | OK with TPs #4, #5, #6, #7Yes to Q1 |
| Huawei | Agree with the TPsYes to Q1. |
| Nokia, NSB | Ok witht the TPs. Q1: yes |
| Sharp | Agree with the TPs.Yes to Q1. |
| LG Electronics | Agree with the TPs.Regarding Q1, if the intention of the question is that the configurability of the parameter *useInterlacePUCCH-PUSCH* is not per BWP but per serving cell, the answer is Yes. |
| MediaTek | Agree with the TPsYes to Q1 |
| Samsung | Agree with the TPsYes to Q1 |
| Qualcomm | Agree with the TPsYes to Q1 |
| Intel | Agree with the TPYes to Q1. |
| OPPO | TP OKYes to Q1 |
| vivo | Agree with the alignment of the parameters.Yes to Q1. |
| Spreadtrum | Agree with the TPYes to Q1 |

### TP for 38.211

--------------------------------------------- Text Proposal (TP#4) for 38.211 ----------------------------------------------

\*\*\* Unchanged text omitted \*\*\*

6.3.2.2.2 Cyclic shift hopping

The cyclic shift $α$ varies as a function of the symbol and slot number according to

$$α\_{l}=\frac{2π}{N\_{sc}^{RB}}\left(\left(m\_{0}+m\_{cs}+m\_{int}+n\_{cs}\left(n\_{s,f}^{μ},l+l'\right)\right) mod N\_{sc}^{RB}\right)$$

where

- $n\_{s,f}^{μ}$ is the slot number in the radio frame

- $l$ is the OFDM symbol number in the PUCCH transmission where $l=0$ corresponds to the first OFDM symbol of the PUCCH transmission,

- $l'$ is the index of the OFDM symbol in the slot that corresponds to the first OFDM symbol of the PUCCH transmission in the slot given by [5, TS 38.213]

-  is given by [5, TS 38.213] for PUCCH format 0 and 1 while for PUCCH format 3 and 4 is defined in clause 6.4.1.3.3.1

-  except for PUCCH format 0 when it depends on the information to be transmitted according to clause 9.2 of [5, TS 38.213].

- $m\_{int}$ is given by

- $m\_{int}=5n\_{IRB}^{μ}$ for PUCCH formats 0 and 1 if PUCCH shall use interlaced mapping according to any of the higher-layer parameters *~~useInterlacePUCCH-Common-r16~~* ~~or~~ *~~useInterlacePUCCH-Dedicated-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* and *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated*, where $n\_{IRB}^{μ}$ is the resource block number within the interlace;

- $m\_{int}=0$ otherwise

\*\*\* Unchanged text omitted \*\*\*

------------------------------------------------------ End Text Proposal -------------------------------------------------------

### TP for 38.212

--------------------------------------------- Text Proposal (TP#5) for 38.212 ----------------------------------------------

\*\*\* Unchanged text omitted \*\*\*

7.3.1.1.1 Format 0\_0

DCI format 0\_0 is used for the scheduling of PUSCH in one cell.

The following information is transmitted by means of the DCI format 0\_0 with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI:

- Identifier for DCI formats – 1 bit

- The value of this bit field is always set to 0, indicating an UL DCI format

- Frequency domain resource assignment –  bits if neither of the higher layer parameters *~~useInterlacePUSCH-Common~~* ~~and~~ *~~userInterlacePUSCH-Dedicated~~* *useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* and *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is configured, where  is defined in clause 7.3.1.0

- For PUSCH hopping with resource allocation type 1:

-  MSB bits are used to indicate the frequency offset according to Clause 6.3 of [6, TS 38.214], where  if the higher layer parameter *frequencyHoppingOffsetLists* contains two offset values and  if the higher layer parameter *frequencyHoppingOffsetLists* contains four offset values

-  bits provides the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]

- For non-PUSCH hopping with resource allocation type 1:

-  bits provides the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]

- if any of the higher layer parameters *~~useInterlacePUSCH-Common~~* ~~and~~ *~~userInterlacePUSCH-Dedicated~~* *useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* and *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is configured

- [5 or 5+Y] bits provide the frequency domain resource allocation according to Clause 6.1.2.2.3 of [6, TS 38.214] if the subcarrier spacing for the active UL bandwidth part is 30 kHz

- [6 or 6+Y] bits provide the frequency domain resource allocation according to Clause 6.1.2.2.3 of [6, TS 38.214] if the subcarrier spacing for the active UL bandwidth part is 15 kHz

\*\*\* Unchanged text omitted \*\*\*

The following information is transmitted by means of the DCI format 0\_0 with CRC scrambled by TC-RNTI:

- Identifier for DCI formats – 1 bit

- The value of this bit field is always set to 0, indicating an UL DCI format

- Frequency domain resource assignment – number of bits determined by the following:

- bits if the higher layer parameter *~~useInterlacePUSCH-Common-r16~~* *useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* is not configured, where

-  is the size of the initial UL bandwidth part.

- For PUSCH hopping with resource allocation type 1:

-  MSB bits are used to indicate the frequency offset according to Table 8.3-1 in Clause 8.3 of [5, TS 38.213], where  if  and  otherwise

-  bits provides the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]

- For non-PUSCH hopping with resource allocation type 1:

-  bits provides the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]

- if the higher layer parameter *~~useInterlacePUSCH-Common-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* is configured

- 5 bits provide the frequency domain resource allocation according to Clause 6.1.2.2.3 of [6, TS 38.214] if the subcarrier spacing for the active UL bandwidth part is 30 kHz

- 6 bits provide the frequency domain resource allocation according to Clause 6.1.2.2.3 of [6, TS 38.214] if the subcarrier spacing for the active UL bandwidth part is 15 kHz

\*\*\* Unchanged text omitted \*\*\*

7.3.1.1.2 Format 0\_1

\*\*\* Unchanged text omitted \*\*\*

- Frequency domain resource assignment – number of bits determined by the following, where  is the size of the active UL bandwidth part:

- If higher layer parameter *~~useInterlacePUSCH-Dedicated-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is not configured

-  bits if only resource allocation type 0 is configured, where  is defined in Clause 6.1.2.2.1 of [6, TS 38.214],

- bits if only resource allocation type 1 is configured, or  bits if both resource allocation type 0 and 1 are configured.

- If both resource allocation type 0 and 1 are configured, the MSB bit is used to indicate resource allocation type 0 or resource allocation type 1, where the bit value of 0 indicates resource allocation type 0 and the bit value of 1 indicates resource allocation type 1.

- For resource allocation type 0, the  LSBs provide the resource allocation as defined in Clause 6.1.2.2.1 of [6, TS 38.214].

- For resource allocation type 1, the  LSBs provide the resource allocation as follows:

- For PUSCH hopping with resource allocation type 1:

-  MSB bits are used to indicate the frequency offset according to Clause 6.3 of [6, TS 38.214], where  if the higher layer parameter *frequencyHoppingOffsetLists* contains two offset values and  if the higher layer parameter *frequencyHoppingOffsetLists* contains four offset values

-  bits provides the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]

- For non-PUSCH hopping with resource allocation type 1:

-  bits provides the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]

- If the higher layer parameter *~~useInterlacePUSCH-Dedicated-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is configured

- 5 + Y bits provide the frequency domain resource allocation according to Clause 6.1.2.2.3 of [6, TS 38.214] if the subcarrier spacing for the active UL bandwidth part is 30 kHz. The 5 MSBs provide the interlace allocation and the Y LSBs provide the RB set allocation.

- 6 + Y bits provide the frequency domain resource allocation according to Clause 6.1.2.2.3 of [6, TS 38.214] if the subcarrier spacing for the active UL bandwidth part is 15 kHz. The 6 MSBs provide the interlace allocation and the Y LSBs provide the RB set allocation.

The value of Y is determined by $\left⌈log\_{2}\left(\frac{N\left(N+1\right)}{2}\right)\right⌉$ where *N* is the number of RB sets contained in the BWP as defined in clause x of [x].

If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part and if both resource allocation type 0 and 1 are configured for the indicated bandwidth part, the UE assumes resource allocation type 0 for the indicated bandwidth part if the bitwidth of the "Frequency domain resource assignment" field of the active bandwidth part is smaller than the bitwidth of the "Frequency domain resource assignment" field of the indicated bandwidth part.

\*\*\* Unchanged text omitted \*\*\*

------------------------------------------------------ End Text Proposal -------------------------------------------------------

### TP for 38.213

--------------------------------------------- Text Proposal (TP#6) for 38.213 ----------------------------------------------

\*\*\* Unchanged text omitted \*\*\*

8.1A PUSCH for Type-2 random access procedure

\*\*\* Unchanged text omitted \*\*\*

For a PUSCH transmission with frequency hopping in a slot, when indicated by *msgA-intraSlotFrequencyHopping* for the active UL BWP, the frequency offset for the second hop [6, TS 38.214] is determined as described in Clause 8.3, Table 8.3-1 using *msgA-HoppingBits instead of* . If *guardPeriodMsgAPUSCH* is provided, a first symbol of the PUSCH transmission after frequency hopping is separated by *guardPeriodMsgAPUSCH* symbols from a last symbol of the PUSCH transmission before frequency hopping; otherwise, there is no time separation of the PUSCH transmission before and after frequency hopping. If the UE is provided with *~~useInterlacePUSCH-Common~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon*, it shall transmit PUSCH without frequency hopping. A PUSCH transmission uses a same spatial filter as an associated PRACH transmission.

\*\*\* Unchanged text omitted \*\*\*

8.3 PUSCH scheduled by RAR UL grant

\*\*\* Unchanged text omitted \*\*\*

The frequency domain resource allocation is by uplink resource allocation type 1 if *~~useInterlacePUSCH-Common~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* is not provided and by uplink resource allocation type 2 if *~~useInterlacePUSCH-Common~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* is provided [6, TS 38.214]. For an initial UL BWP size of  RBs, if *~~useInterlacePUSCH-Common~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* is not provided, a UE processes the frequency domain resource assignment field as follows

\*\*\* Unchanged text omitted \*\*\*

9.2.1 PUCCH Resource Sets

If a UE does not have dedicated PUCCH resource configuration, provided by *PUCCH-ResourceSet* in *PUCCH-Config*, a PUCCH resource set is provided by *pucch-ResourceCommon* through an index to a row of Table 9.2.1-1 for transmission of HARQ-ACK information on PUCCH in an initial UL BWP of  PRBs.

The PUCCH resource set includes sixteen resources, each corresponding to a PUCCH format, a first symbol, a duration, a PRB offset , and a cyclic shift index set for a PUCCH transmission.

The UE transmits a PUCCH using frequency hopping if not provided *~~useInterlacePUSCH-Common-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon*; otherwise, the UE transmits a PUCCH without frequency hopping.

\*\*\* Unchanged text omitted \*\*\*

If  and a UE is provided a PUCCH resource by *pucch-ResourceCommon* and is not provided *~~useInterlacePUSCH-Common-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon*

- the UE determines the PRB index of the PUCCH transmission in the first hop as  and the PRB index of the PUCCH transmission in the second hop as 

- the UE determines the initial cyclic shift index in the set of initial cyclic shift indexes as 

If a UE is provided a PUCCH resource by *pucch-ResourceCommon* and is provided *~~useInterlacePUSCH-Common-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon*

- the UE determines for the PUCCH resource an interlace index $m$ as $m=\left(m\_{0}+\left⌊{r\_{PUCCH}}/{N\_{CS}}\right⌋\right)modM$ where $M$ is a number of interlaces [4, TS 38.211] and $m\_{0}=RB\_{BWP}^{offset}$ is an interlace index offset and $RB\_{BWP}^{offset}$ is as given in Table 9.2.1-1

- the UE determines an initial cyclic shift index in a set of initial cyclic shift indexes as $r\_{PUCCH}modN\_{CS}$, where $N\_{CS}$ is the total number of initial cyclic shifts indexes in the set of initial cyclic shift indexes in Table 9.2.1-1

- if *pucch-ResourceCommon* indicates

- index 0: the first symbol is 9 for a PUCCH resource with PUCCH format 0 if $r\_{PUCCH}\geq 10$

- index 1 or 2: the first symbol is 9 for a PUCCH resource with PUCCH format 0 if $r\_{PUCCH}=15$

- index 3, 7, or 11: an orthogonal cover code with index 1 is used for a PUCCH resource with PUCCH format 1 if $r\_{PUCCH}\geq 10$

- the UE does not expect *pucch-ResourceCommon* to indicate index 15

\*\*\* Unchanged text omitted \*\*\*

A PUCCH resource includes the following parameters:

- a PUCCH resource index provided by *pucch-ResourceId*

- an index of the first PRB prior to frequency hopping or for no frequency hopping by *startingPRB*, if a UE is not provided *~~useInterlacePUCCH-Dedicated-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated*

- an index of the first PRB after frequency hopping by *secondHopPRB*, if a UE is not provided *~~useInterlacePUCCH-Dedicated-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated*

- an indication for intra-slot frequency hopping by *intraSlotFrequencyHopping*, if a UE is not provided *~~useInterlacePUCCH-Dedicated-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated*

- an index of a first interlace by *interlace0*, if a UE is provided *~~useInterlacePUCCH-Dedicated-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated*

- if provided, an index of a second interlace by *interlace1*, if a UE is provided *~~useInterlacePUCCH-Dedicated-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated*

- an index of an RB set by *rb-SetIndex*, if a UE is provided *~~useInterlacePUCCH-Dedicated-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated*

- a configuration for a PUCCH format, from PUCCH format 0 through PUCCH format 4, provided by *format*

The UE expects that either none or both of *~~useInterlacePUCCH-Common-r16~~* ~~and~~ *~~useInterlacePUCCH-Dedicated-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* and *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* are provided.

If a UE is provided *~~useInterlacePUCCH-Dedicated-r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated*, the UE determines available RBs for PUCCH transmissions as the intersection of RBs corresponding to an interlace index provided by *interlace0* and, if provided, *interlace1*, and RBs of an RB set provided by *rb-SetIndex*. The intersection results in $M\_{interlace,0}^{PUCCH}$ RBs in the first interlace and the UE expects that $M\_{interlace,0}^{PUCCH}$ is either 10 or 11. If *interlace1* is provided, the intersection results in $M\_{interlace,1}^{PUCCH}$ RBs in the second interlace and the UE expects that $M\_{interlace,1}^{PUCCH}$ is either 10 or 11.

If the *format* indicates *PUCCH-format0*,the PUCCH format configured for a PUCCH resource is PUCCH format 0, where the PUCCH resource also includes an index for an initial cyclic shift provided by *initialCyclicShift*, a number of symbols for a PUCCH transmission provided by *nrofSymbols*, a first symbol for the PUCCH transmission provided by *startingSymbolIndex*.

If the *format* indicates *PUCCH-format1*,the PUCCH format configured for a PUCCH resource is PUCCH format 1, where the PUCCH resource also includes an index for an initial cyclic shift provided by *initialCyclicShift*, a number of symbols for a PUCCH transmission provided by *nrofSymbols*, a first symbol for the PUCCH transmission provided by *startingSymbolIndex*, and an index for an orthogonal cover code by *timeDomainOCC*.

If the *format* indicates *PUCCH-format2* or *PUCCH-format3*,the PUCCH format configured for a PUCCH resource is PUCCH format 2 or PUCCH format 3, respectively, where the PUCCH resource also includes a number of PRBs provided by *nrofPRBs*, a number of symbols for a PUCCH transmission provided by *nrofSymbols*, and a first symbol for the PUCCH transmission provided by *startingSymbolIndex*. If a UE is provided by *~~useInterlacePUCCH-Dedicated -r16~~ useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated,* and the *format* indicates *PUCCH-format2-r16* or *PUCCH-format3-r16*,the PUCCH resource also includes, if provided, an orthogonal cover code length by *OCC-Length-r16* and an orthogonal cover code index by *OCC-Index-r16*. If the *format* indicates *PUCCH-format3-r16*, the UE assumes that the $M\_{RB}^{PUCCH,3}$ [4, TS38.211] PRBs with the lowest indexes within the first, and if configured, second interlace are used for PUCCH transmission.

\*\*\* Unchanged text omitted \*\*\*

------------------------------------------------------ End Text Proposal -------------------------------------------------------

### TP for 38.214

--------------------------------------------- Text Proposal (TP#7) for 38.214 ----------------------------------------------

\*\*\* Unchanged text omitted \*\*\*

6.1.2.2 Resource allocation in frequency domain

The UE shall determine the resource block assignment in frequency domain using the resource allocation field in the detected PDCCH DCI except for a PUSCH transmission scheduled by a RAR UL grant or fallbackRAR UL grant, in which case the frequency domain resource allocation is determined according to clause 8.3 of [6, 38.213] or clause X.Y of [6, 38.213] respectively. Three uplink resource allocation schemes type 0, type 1 and type 2 are supported. Uplink resource allocation scheme type 0 is supported for PUSCH only when transform precoding is disabled. Uplink resource allocation scheme type 1 and type 2 are supported for PUSCH for both cases when transform precoding is enabled or disabled.

If the scheduling DCI is configured to indicate the uplink resource allocation type as part of the *Frequency domain resource* assignment field by setting a higher layer parameter r*esourceAllocation* in *pusch-Config* to 'dynamicSwitch', for DCI format 0\_1 or setting a higher layer parameter *resourceAllocation-ForDCIFormat0\_2* in *pusch-Config* to 'dynamicswitch' for DCI format 0\_2, the UE shall use uplink resource allocation type 0 or type 1 as defined by this DCI field. Otherwise the UE shall use the uplink frequency resource allocation type as defined by the higher layer parameter *resourceAllocation* for DCI format 0\_1 or the higher layer parameter *resourceAllocation-ForDCIFormat0\_2* for DCI format 0\_2. The UE shall assume that when the scheduling PDCCH is received with DCI format 0\_1 and *~~useInterlacePUSCH-Dedicated~~* ~~is set to 'enabled'~~ *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is configured, uplink type 2 resource allocation is used.

The UE shall assume that when the scheduling PDCCH is received with DCI format 0\_0, then uplink resource allocation type 1 is used, except when any of the higher layer parameters *~~useInterlacePUSCH-Common~~* ~~or~~ *~~useInterlacePUSCH-Dedicated~~* ~~are set to 'enabled'~~ *useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* and *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is configured in which case uplink resource allocation type 2 is used.

The UE expects that either none or both of *~~useInterlacePUSCH-Common~~* ~~and~~ *~~useInterlacePUSCH-Dedicated~~* ~~is set to 'enabled'~~ *useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* and *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is configured.

~~The UE expects that either none or both of~~ *~~useInterlacePUSCH-Common~~* ~~and~~ *~~useInterlacePUCCH-Common~~* ~~is set to 'enabled'.~~

\*\*\* Unchanged text omitted \*\*\*

6.1.2.3 Resource allocation for uplink transmission with configured grant

\*\*\* Unchanged text omitted \*\*\*

- Frequency domain resource allocation is determined by the *N* LSB bits in the higher layer parameter *frequencyDomainAllocation*, forming a bit sequence $f\_{17}, …, f\_{1}, f\_{0}$, where $f\_{0}$ is the LSB, according to the procedure in Clause 6.1.2.2 and *N* is determined as the size of frequency domain resource assignment field in DCI format 0\_1 for a given resource allocation type indicated by *resourceAllocation,* except if *~~useInterlacePUSCH-Dedicated~~* ~~is set to 'enabled'~~ *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is configured, in which case uplink type 2 resource allocation is used wherein the UE interprets the LSB bits in the higher layer parameter *frequencyDomainAllocation* as for the frequency domain resource assignment field of DCI 0\_1 according to the procedure in Clause 6.1.2.2.3*;*

\*\*\* Unchanged text omitted \*\*\*

------------------------------------------------------ End Text Proposal -------------------------------------------------------

### 2.4.1 Summary of Dicussion

There is consensus to support TP#4,5,6,7. There is also consensus that the answer to Q1 is “Yes.”

Q1: “Shall the UE expect that *useInterlacePUCCH-PUSCH* is configured the same way for all BWPs of a serving cell?”

Based on this, the FL recommendation is as follows:

1. Support TP#4,5,6,7 for 38.211,212,213,214 respectively
2. FL to draft TP to capture the consensus that the UE shall expect that *useInterlacePUCCH-PUSCH* is configured the same way for all configured BWPs of a serving cell. Endorsement of TP by 4/28.

# References

1. R1-2001533 Maintainance on uplink signals and channels Huawei, HiSilicon
2. R1-2001651 Remaining issues on physical UL channel design in unlicensed spectrum vivo
3. R1-2001704 Remaining issues on the UL channels for NR-U ZTE, Sanechips
4. R1-2001758 Discussion on the remaining issues of UL signals and channels OPPO
5. R1-2001875 Remaining issues on UL signals and channels for NR-U Fujitsu
6. R1-2001903 Remaining issues on UL signals and channels for NR-U MediaTek Inc.
7. R1-2001934 Remaining issues of UL signals and channels for NR-U LG Electronics
8. R1-2001973 Remaining issues for UL signals and channels for NR-U Lenovo, Motorola Mobility
9. R1-2001986 UL signals and channels for NR-unlicensed Intel Corporation
10. R1-2002030 UL signals and channels Ericsson
11. R1-2002075 TP for SRS configuration CATT
12. R1-2002116 UL signals and channels for NR-U Samsung
13. R1-2002192 Remaining Issues on UL Signals and Channels for NR-U Nokia, Nokia Shanghai Bell
14. R1-2002246 UL signals and channels ETRI
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16. R1-2002321 Remaining issues of UL signals and channels Apple
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19. R1-2002433 Remaining issues on UL signals and channels for NR-U NTT DOCOMO, INC.
20. R1-2002529 TP for UL signals and channels for NR-U Qualcomm Incorporated
21. R1-2002036, “Feature lead summary for Maintenance of UL Signals and Channels,” Moderator (Ericsson), RAN1#100bis-e, April, 2020.