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

e-Meeting, 16th – 27th August, 2021

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| *CR-Form-v12.1* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
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|  | **38.214** | **CR** | **xxxx** | **rev** | **-** | **Current version:** | **16.6.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Correction on frequency hopping for multi-PUSCH scheduling with single DCI | | | | | | | | | |
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| ***Source to WG:*** | Moderator (vivo), Ericsson, Qualcomm, Huawei/HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | TSG RAN WG1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_unlic-Core | | | | |  | ***Date:*** | | | 2021-08-20 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | 38.214 Section 6.3.1 specifies that intra- and inter-slot frequency hopping is applicable as follows  - Intra-slot frequency hopping, applicable to single slot and multi-slot PUSCH transmission.  - Inter-slot frequency hopping, applicable to multi-slot PUSCH transmission.   1. RAN1 specified support for multi-PUSCH scheduling in Rel-16, in which multiple PUSCHs are scheduled by a single DCI. In the above frequency hopping procedure, it is not clear if PUSCH transmission due to multi-PUSCH scheduling by a single DCI is classified as "single-slot" or "multi-slot." As a consequence, it is not clear whether only intra-slot frequency hopping applies, or both intra-slot and inter-slot frequency hopping applies. 2. For operation with shared spectrm channel access, if frequency hopping is applied for a PUSCH, there will be LBT issue when two hop PUSCH transmission is located in different RB sets. | | | | | | | | |
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| ***Summary of change:*** | | 1. Clarification that only intra-slot frequency hopping applies to multiple PUSCH transmissions scheduled with a single DCI 2. Clarification that frequency hopping for PUSCH transmissions is not applicable when operation with shared spectrum channel access. | | | | | | | | |
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| ***Consequences if not approved:*** | | 1. The frequency hopping procedure for multiple PUSCH transmissions scheduled with a single DCI is undefined. 2. Channel access mechanism for PUSCH transmission with frequency hopping in operation with shared spectrum channel access is undefined. | | | | | | | | |
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| ***Clauses affected:*** | | 6.3.1 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
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| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

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

6.3 UE PUSCH frequency hopping procedure

6.3.1 Frequency hopping for PUSCH repetition Type A

For PUSCH repetition Type A (as determined according to procedures defined in Clause 6.1.2.1 for scheduled PUSCH, or Clause 6.1.2.3 for configured PUSCH), a UE is configured for frequency hopping by the higher layer parameter *frequencyHoppingDCI-0-2* in *pusch-Config* for PUSCH transmission scheduled by DCI format 0\_2, and by *frequencyHopping* provided in *pusch-Config* for PUSCH transmission scheduled by a DCI format other than 0\_2*,* and by *frequencyHopping* provided in *configuredGrantConfig* for configured PUSCH transmission. One of two frequency hopping modes can be configured:

-  Intra-slot frequency hopping, applicable to single slot and multi-slot PUSCH transmission and each of multiple PUSCH transmissions scheduled by a DCI if the higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH* is configured.

- Inter-slot frequency hopping, applicable to multi-slot PUSCH transmission.

For operation with shared spectrum channel access, intra-slot frequency hopping and inter-slot frequency hopping are not applicable.

In case of resource allocation type 2, the UE transmits PUSCH without frequency hopping.

In case of resource allocation type 1, whether or not transform precoding is enabled for PUSCH transmission, the UE may perform PUSCH frequency hopping, if the frequency hopping field in a corresponding detected DCI format or in a random access response UL grant is set to 1, or if for a Type 1 PUSCH transmission with a configured grant the higher layer parameter *frequencyHoppingOffset* is provided, otherwise no PUSCH frequency hopping is performed. When frequency hopping is enabled for PUSCH, the RE mapping is defined in clause 6.3.1.6 of [4, TS 38.211].

For a PUSCH scheduled by RAR UL grant, fallbackRAR UL grant, or by DCI format 0\_0 with CRC scrambled by TC-RNTI, frequency offsets are obtained as described in clause 8.3 of [6, TS 38.213]. Otherwise, for a PUSCH scheduled by DCI format 0\_0/0\_1 or a PUSCH based on a Type2 configured UL grant activated by DCI format 0\_0/0\_1 and for resource allocation type 1, frequency offsets are configured by higher layer parameter *frequencyHoppingOffsetLists* in *pusch-Config*. For a PUSCH scheduled by DCI format 0\_2 or a PUSCH based on a Type2 configured UL grant activated by DCI format 0\_2 and for resource allocation type 1, frequency offsets are configured by higher layer parameter *frequencyHoppingOffsetListsDCI-0-2* in *pusch-Config*.

- When the size of the active BWP is less than 50 PRBs, one of two higher layer configured offsets is indicated in the UL grant.

- When the size of the active BWP is equal to or greater than 50 PRBs, one of four higher layer configured offsets is indicated in the UL grant.

For PUSCH based on a Type1 configured UL grant the frequency offset is provided by the higher layer parameter *frequencyHoppingOffset* in *rrc-ConfiguredUplinkGrant*.

For a MsgA PUSCH the frequency offset is provided by the higher layer parameter as described in [6, TS 38.213].

In case of intra-slot frequency hopping, the starting RB in each hop is given by:

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where *i*=0 and *i*=1 are the first hop and the second hop respectively, and  is the starting RB within the UL BWP, as calculated from the resource block assignment information of resource allocation type 1 (described in Clause 6.1.2.2.2) or as calculated from the resource assignment for MsgA PUSCH (described in [6, TS 38.213]) and is the frequency offset in RBs between the two frequency hops. The number of symbols in the first hop is given by , the number of symbols in the second hop is given by , where is the length of the PUSCH transmission in OFDM symbols in one slot.

In case of inter-slot frequency hopping, the starting RB during slot  is given by:

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where  is the current slot number within a radio frame, where a multi-slot PUSCH transmission can take place,  is the starting RB within the UL BWP, as calculated from the resource block assignment information of resource allocation type 1 (described in Clause 6.1.2.2.2) and is the frequency offset in RBs between the two frequency hops.

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