**3GPP TSG-RAN WG1 Meeting #107-e *R1-21xxxxx***

e-Meeting, 11th – 19th November, 2021

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.1* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.214** | **CR** | **xxxx** | **rev** | **-** | **Current version:** | **16.7.0** |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Correction on frequency hopping for PUSCH and SRS | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Moderator (vivo), Huawei, HiSilicon, Ericsson, Lenovo, Motorola Mobility | | | | | | | | | |
| ***Source to TSG:*** | TSG RAN WG1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_unlic-Core | | | | |  | ***Date:*** | | | 2021-11-17 |
|  |  | | | |  | |  | | |  |
| ***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:*** | | 1. 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.  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.   1. For operation with shared spectrum, if frequency hopping is enabled for PUSCH or SRS, the different hops of a transmission may be located in different RB sets. As a consequence, there will be channel access problem for the second hop transmission. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Clarification that only intra-slot frequency hopping applies to multiple PUSCH transmissions scheduled with a single DCI 2. Clarification that UE doesn’t expect two or multiple hops of a PUSCH or SRS transmission are in different RB set. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | 1. The frequency hopping procedure for multiple PUSCH transmissions scheduled with a single DCI is undefined. 2. There is channel access problem for the case that the different hops of a PUSCH or SRS transmission may be located in different RB sets. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.3.1, 6.3.2, 6.2.1.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

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

#### 6.2.1.1 UE SRS frequency hopping procedure

For a given SRS resource, the UE is configured with repetition factor R∈{1,2,4} by higher layer parameter *resourceMapping* in *SRS-Resource* where *R*≤*Ns*. When frequency hopping within an SRS resource in each slot is not configured (*R=Ns*), each of the antenna ports of the SRS resource in each slot is mapped in all the  symbols to the same set of subcarriers in the same set of PRBs. When frequency hopping within an SRS resource in each slot is configured without repetition (*R=1*), according to the SRS hopping parameters , and defined in Clause 6.4.1.4 of [4, TS 38.211], each of the antenna ports of the SRS resource in each slot is mapped to different sets of subcarriers in each OFDM symbol, where the same transmission comb value is assumed for different sets of subcarriers. When both frequency hopping and repetition within an SRS resource in each slot are configured (*Ns=4, R=2*), each of the antenna ports of the SRS resource in each slot is mapped to the same set of subcarriers within each pair of R adjacent OFDM symbols, and frequency hopping across the two pairs is according to the SRS hopping parameters , and .

For operation with shared spectrum channel access, the UE does not expect that multiple hops of an SRS resource transmission are in different RB sets.

A UE may be configured  adjacent symbol aperiodic SRS resource with intra-slot frequency hopping within a bandwidth part, where the full hopping bandwidth is sounded with an equal-size subband across  symbols when frequency hopping is configured with *R=1*. A UE may be configured  adjacent symbols aperiodic SRS resource with intra-slot frequency hopping within a bandwidth part, where the full hopping bandwidth is sounded with an equal-size subband across two pairs of *R* adjacent OFDM symbols, when frequency hopping is configured with *R=2*. Each of the antenna ports of the SRS resource is mapped to the same set of subcarriers within each pair of R adjacent OFDM symbols of the resource.

\*\*\* 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, the UE does not expect that two hops of a PUSCH transmission are in different RB sets.

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].

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

6.3.2 Frequency hopping for PUSCH repetition Type B

For PUSCH repetition Type B (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, by *frequencyHoppingDCI-0-1* provided in *pusch-Config* for PUSCH transmission scheduled by DCI format 0\_1, and by *frequencyHoppingPUSCH-RepTypeB* provided in *rrc-ConfiguredUplinkGrant* for Type 1 configured PUSCH transmission. The frequency hopping mode for Type 2 configured PUSCH transmission follows the configuration of the activating DCI format. One of two frequency hopping modes can be configured:

- Inter-repetition frequency hopping

- Inter-slot frequency hopping

For operation with shared spectrum channel access, the UE does not expect that two hops of a PUSCH transmission are in different RB sets.

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 is set to 1, or if for a Type 1 PUSCH transmission with a configured grant the higher layer parameter *frequencyHoppingPUSCH-RepTypeB* 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].

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