**3GPP TSG RAN WG1 #117 R1-240xxxx**

**Fukuoka, Japan, May 20th – 24th, 2024**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **38.214** | **CR** |  | **rev** | **-** | **Current version:** | **16.16.0** |  |
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| *For* [***HELP***](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:***  | Draft CR on mDCI based mTRP out-of-order operation |
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| ***Source to WG:*** | Samsung, Nokia |
| ***Source to TSG:*** | RAN1 |
|  |  |
| ***Work item code:*** | NR\_eMIMO-Core |  | ***Date:*** | 2024-05-10 |
|  |  |  |  |  |
| ***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 canbe 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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | To enable out-of-order operation for PDSCH or PUSCH, the only condition in current specification is when a UE is configured with two different *coresetPoolIndexes* and two scheduled PDSCHs or PUSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex*. A basic UE capability, *multiDCI-MultiTRP-r16*, is defined for a UE to support multi-DCI based multi-TRP scheme with configuration of two different *coresetPoolIndexes*. To support out-of-order operation for PDSCH and PUSCH, separate UE capabilities, *outOfOrderOperationDL-r16* and *outOfOrderOperationUL-r16*, are defined which are not covered by a basic UE capability. Then, there could be a case when a UE reports a basic capability, *multiDCI-MultiTRP-r16,* but does not report additional optional features for out-of-order operation, *outOfOrderOperationDL-r16* and/or *outOfOrderOperationUL-r16.* In this case, the UE can support multi-DCI based multi-TRP scheme, but cannot support out-of-order operation. Hence, we would like to add a condition, when a UE reports such optional capability supporting out-of-order operation, in the specification to enable out-of-order operation. |
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| ***Summary of change:*** | To enable out-of-order operation, add a condition like when a UE reports such optional capability supporting out-of-order operation. |
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| ***Consequences if not approved:*** | Based on current specification, a UE reporting a basic capability, *multiDCI-MultiTRP-r16,* but not reporting additional optional features for out-of-order operation, *outOfOrderOperationDL-r16* and/or *outOfOrderOperationUL-r16*, shall support out-of-order operation, which is not aligned with UE capability signaling structure. |
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| ***Clauses affected:*** | 5.1, 6.1 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  |  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |
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| ***This CR's revision history:*** | This is the first version of the CR. |

5.1 UE procedure for receiving the physical downlink shared channel

< Unchanged parts are omitted >

Except for the case when a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* and PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex* and the UE reports its capability of *outOfOrderOperationDL-r16,* in a given scheduled cell, the UE is not expected to receive a first PDSCH and a second PDSCH, starting later than the first PDSCH, with its corresponding HARQ-ACK assigned to be transmitted on a resource ending before the start of a different resource for the HARQ-ACK assigned to be transmitted for the first PDSCH, where the two resources are in different slots for the associated HARQ-ACK transmissions, each slot is composed of $N\_{sym}^{slot}$ symbols [4] or a number of symbols indicated by *subslotLengthForPUCCH* if provided, and the HARQ-ACK for the two PDSCHs are associated with the HARQ-ACK codebook of the same priority. Except for the case when a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* and PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex* and the UE reports its capability of *outOfOrderOperationDL-r16,* in a given scheduled cell, the UE is not expected to receive a first PDSCH, and a second PDSCH, starting later than the first PDSCH, with its corresponding HARQ-ACK assigned to be transmitted on a resource ending before the start of a different resource for the HARQ-ACK assigned to be transmitted for the first PDSCH if the HARQ-ACK for the two PDSCHs are associated with HARQ-ACK codebooks of different priorities.

< Unchanged parts are omitted >

When PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex* and the UE reports its capability of *outOfOrderOperationDL-r16,* the following operations are allowed:

- For any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start receiving a first PDSCH starting in symbol *j* by a PDCCH associated with a value of *coresetPoolIndex* ending in symbol *i*, the UE can be scheduled to receive a PDSCH starting earlier than the end of the first PDSCH with a PDCCH associated with a different value of *coresetPoolIndex* that ends later than symbol *i*.

- In a given scheduled cell, the UE can receive a first PDSCH in slot *i*, with the corresponding HARQ-ACK assigned to be transmitted in slot *j*, and a second PDSCH associated with a value of *coresetPoolIndex* different from that of the first PDSCH starting later than the first PDSCH with its corresponding HARQ-ACK assigned to be transmitted in a slot before slot *j*.

< Unchanged parts are omitted >

6.1 UE procedure for transmitting the physical uplink shared channel

< Unchanged parts are omitted >

Except for the case when a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active BWP of a serving cell and PDCCHs that schedule two non-overlapping in time domain PUSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex* and the UE reports its capability of *outOfOrderOperationUL-r16,* for any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH ending in symbol *i*, the UE is not expected to be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH that ends later than symbol *i*.

< Unchanged parts are omitted >

If a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active BWP of a serving cell and PDCCHs that schedule two non-overlapping in time domain PUSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex* and the UE reports its capability of *outOfOrderOperationUL-r16,* for any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH associated with a value of *coresetPoolIndex* ending in symbol *i*, the UE can be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH associated with a different value of *coresetPoolIndex* that ends later than symbol *i*.