3GPP TSG-RAN WG4 Meeting # 95-e R4-2008676

Electronic Meeting, 25 May – 5 June, 2020

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **38.133** | **CR** | **0764** | **rev** | **1** | **Current version:** | **16.3.0** |  |
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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 |  | Core Network |  |

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| ***Title:***  | CR on introduction of RRM requirements for BWP switching delay on multiple CCs |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_RRM\_enh-Core |  | ***Date:*** | 2020-05-08 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | Delay requirements for BWP switching on multiple CCs is missing. |
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| ***Summary of change:*** | Introduce delay requirements for BWP switching on multiple CCs. |
|  |  |
| ***Consequences if not approved:*** | Delay requirements for BWP switching on multiple CCs is missing. |
|  |  |
| ***Clauses affected:*** | 8.6 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  |  |
| ***affected:*** | **x** |  |  Test specifications | TS 38.533 |
| ***(show related CRs)*** |  | **x** |  O&M Specifications |   |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

### <Start of Change 1>

## 8.6 Active BWP switch delay

### 8.6.1 Introduction

The requirements in this clause apply for a UE configured with more than one BWP on PCell or any activated SCell in standalone NR or NE-DC, PCell, PSCell or any activated SCell in MCG or SCG in NR-DC, or PSCell or any activated SCell in SCG in EN-DC. UE shall complete the switch of active DL and/or UL BWP within the delay defined in this clause.

### 8.6.2 DCI and timer based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC.

For DCI-based BWP switch, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of TBWPswitchDelay which starts from the beginning of DL slot n.

The UE is not required to transmit UL signals or receive DL signals until the first DL or UL slot occurs right after a time duration of TBWPswitchDelay which starts from the beginning of DL slot n except DCI triggering BWP switch on the cell where DCI-based BWP switch occurs. The UE is not required to follow the requirements defined in this clause when performing a DCI-based BWP switch between the BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths.

For timer-based BWP switch, the UE shall start BWP switch at DL slot n, where slot n is the first slot of a DL subframe (FR1) or DL half-subframe (FR2) immediately after a BWP-inactivity timer *bwp-InactivityTimer* [2] expires on a serving cell, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of TBWPswitchDelay which starts from the beginning of DL slot n.

The UE is not required to transmit UL signals or receive DL signals during time duration TBWPswitchDelay after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration TBWPswitchDelay defined in Table 8.6.2-1.

Table 8.6.2-1: BWP switch delay

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | BWP switch delay TBWPswitchDelay (slots) |
| Type 1Note 1 | Type 2Note 1 |
| 0 | 1 | 1 | 3 |
| 1 | 0.5 | 2 | 5 |
| 2 | 0.25 | 3 | 9 |
| 3 | 0.125 | 6 | 18 |
| Note 1: Depends on UE capability.Note 2: If the BWP switch involves changing of SCS, the BWP switch delay is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch. |

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in Clause 8.10 in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in Clause 8.10 in the new BWP.

### 8.6.2A DCI and timer based BWP switch delay on multiple CCs

The requirements in this clause only apply to the case when the same type of BWP switch (either DCI based, timer based or RRC based BWP) is performed on multiple CCs simultaneously or over partially overlapping time period.

#### 8.6.2A.1 Simultaneous DCI and timer based BWP switch delay on multiple CCs

The delay requirements for simultaneous DCI based BWP switch on multiple CCs in this clause apply only if the timing difference among the first symbol of slot carrying DCI for all CCs is received within the MRTD for inter-band CA as defined in clause 7.6.4. The delay requirements for simultaneous timer based BWP switch on multiple CCs in this clause apply only if the timing difference among the beginning of the slot where timer based BWP switching starts for all CCs is within the MRTD for inter-band CA as defined in clause 7.6.4.

For DCI-based BWP switch on multiple CCs, after the UE receives BWP switching request, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch on the first DL or UL slot occurs right after a time duration of TMultipleBWPswitchDelay which starts from the beginning of DL slot n, where slot n is slot which UE receives the earliest BWP switching request among CCs on which UE is performing simultaneous DCI-based BWP switching.

The UE is not required to transmit UL signals or receive DL signals until the first DL or UL slot occurs right after a time duration of TMultipleBWPswitchDelay which starts from the beginning of DL slot n except DCI triggering BWP switch on the cell where DCI-based BWP switch occurs. The UE is not required to follow the requirements defined in this clause when performing a DCI-based BWP switch between the BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths on any serving cell.

For timer-based BWP switch on multiple CCs, UE shall start BWP switch at DL slot n, where slot n is the first slot of a DL subframe (FR1) or DL half-subframe (FR2) immediately after the earliest BWP-inactivity timer *bwp-InactivityTimer* [2] expiration occurs on multiple serving cells, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch on the first DL or UL slot occurs right after a time duration of TMultipleBWPswitchDelay which starts from the beginning of DL slot n.

The UE is not required to transmit UL signals or receive DL signals during time duration TMultipleBWPswitchDelay after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

UE shall finish BWP switch within the time duration TMultipleBWPswitchDelay, which is defined as:

TMultipleBWPswitchDelay = TBWPswitchDelay + N\*(D -1)

Where:

* TBWPswitchDelay is the BWP switching delay on single CC defined in Table 8.6.2-1 depending on UE capability *bwp-SwitchingDelay* [2]
* D is the incremental delay for each additional CC involved in simultaneous BWP switch and depends on UE capability [2].
* For UE which is capable of per-FR gap, N is the number of simultaneous BWP switching on CCs within the same frequency range; For UE which is not capable of per-FR gap, N is the number of simultaneous BWP switching on both frequency ranges.

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in Clause 8.10 in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in Clause 8.10 in the new BWP.

#### 8.6.2A.2 Non-simultaneous DCI based BWP switch delay on multiple CCs

In non-simultaneous case, the DCI-based BWP switch on multiple CCs is triggered over partially overlapping time period. The delay requirements for non-simultaneous DCI based BWP switch on multiple CCs in this clause apply only if:

* the timing difference among the first symbol of slot carrying DCI for all CCs involved in non-simultaneous BWP switch is received exceeds the MRTD for inter-band CA as defined in clause 7.6.4, and
* UE is operating in NR-DC (FR1+FR2), and
* UE is capable of per-FR gap.

For non-simultaneous DCI based BWP switch on multiple CCs, BWP switching delay requirements defined in clause 8.6.2 apply when BWP switching occurs on single CC in the cell group. BWP switching delay requirements defined in clause 8.6.2A.1 apply when simultaneous BWP switching occurs on multiple CCs in the cell group.

#### 8.6.2A.2 Non-simultaneous timer based BWP switch delay on multiple CCs

In non-simultaneous case, the timer-based BWP switch on multiple CCs is triggered over partially overlapping time period. The delay requirements for non-simultaneous timer based BWP switch on multiple CCs in this clause apply only if the timing difference among the beginning of the slot where timer based BWP switching starts for all CCs exceeds the MRTD for inter-band CA as defined in clause 7.6.4.

For timer-based BWP switch, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of TMultipleBWPswitchDelay which starts from the beginning of DL slot n, where slot n is the first slot of a DL subframe (FR1) or DL half-subframe (FR2) immediately after the BWP-inactivity timer *bwp-InactivityTimer* [2] expires on the serving cell.

The UE is not required to transmit UL signals or receive DL signals during time duration TMultipleBWPswitchDelay after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration TMultipleBWPswitchDelay, where the TMultipleBWPswitchDelay is defined as:

TMultipleBWPswitchDelay = TDelay + TNonSimultaneousTimer

Where:

* TDelay is the time delayed by ongoing BWP switching on other single CC or simultaneously triggered multiple CCs.
* TNonSimultaneousTimer = TBWPswitchDelay + D\*(N-1), where:
	+ TBWPswitchDelay is BWP switching delay on single CC defined in Table 8.6.2-1;
	+ D is the incremental delay for each additional CC involved in non-simultaneous BWP switch and depends on UE capability [2];
	+ For UE which is capable of per-FR gap, N=1; For UE which is not capable of per-FR gap, N is the number of timer-based BWP switch on CCs in the other FR whose BWP switching delay periods overlap with TNonSimultaneousTimer.

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in Clause 8.10 in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in Clause 8.10 in the new BWP.

### 8.6.3 RRC based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC.

For RRC-based BWP switch, after the UE receives RRC reconfiguration involving active BWP switching or parameter change of its active BWP, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch occurs on the first DL or UL slot right after a time duration of slots which begins from the beginning of DL slot n, where

DL slot n is the last slot containing the RRC command, and

is the length of the RRC procedure delay in millisecond as defined in clause 12 in TS 38.331 [2], and

 is the time used by the UE to perform BWP switch.

The UE is not required to transmit UL signals or receive DL signals during the time defined by on the cell where RRC-based BWP switch occurs.

### 8.6.3A RRC based BWP switch delay on a multiple CCs

#### 8.6.3A.1 Simultaneous RRC based BWP switch delay on multiple CCs

Requirements in this clause apply only if RRC based BWP switching on multiple CCs for NR-CA is triggered by 1 RRC command.

For RRC-based BWP switch, after the UE receives RRC reconfiguration involving active BWP switching or parameter change of its active BWPs, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch occurs on the first DL or UL slot right after a time duration of slots which begins from the beginning of DL slot n, where

DL slot n is the last slot containing the RRC command, and

is the length of the RRC procedure delay in millisecond as defined in clause 12 in TS 38.331 [2], and

 is the time used by the UE to perform BWP switch.

The UE is not required to transmit UL signals or receive DL signals during the time defined by on the cells where RRC-based BWP switch occurs.

#### 8.6.3A.2 Non-simultaneous RRC based BWP switch delay on multiple CCs

Requirements in this clause apply only if:

* BWP switching on multiple CCs in different cell groups are triggered by separate RRC commands, and
* UE is operating in NR-DC (FR1+FR2), and
* UE is capable of per-FR gap.

For RRC-based BWP switch, the BWP switches in MCG and SCG are performed separately. The BWP delay requirements in clause 8.6.3A.1 shall apply.

### <End of Change 1>