**3GPP TSG-RAN WG4 Meeting #101-bis-e *R4-2202754***

**E-meeting, January 17-25, 2022**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** | **-** | **rev** | **-** | **Current version:** | **17.4.0** |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network |  |

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| ***Title:*** | Draft Big CR on RRM requirements for Rel-17 NR extension to 71GHz | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Intel, Qualcomm | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_ext\_to\_71GHz-Core | | | | |  | ***Date:*** | | | 2022-01-27 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***Release:*** | | | Rel-17 |
|  | *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-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | The existing requirements need to be updated to cover FR2-2  This document includes the endoresed draft CRs:  **Endorsed in RAN4 #101-bis-e**:   |  |  |  | | --- | --- | --- | | TDoc Endorsed CR | CR title | Source companies | | R4-2201198 | Draft CR on BWP switching requirements for extending NR operation to 71GHz | Huawei, HiSilicon | | R4-2202048 | Draft CR for timing requirements for FR2-2 – MRTD, MTTD | Qualcomm | | R4-2202661 | Draft CR to 38.133 Introducing interruption requirements of FR2-2 | vivo | | R4-2202663 | On general measurement requriement for extending NR operation to 71GHz | Ericsson | | R4-2202755 | Draft CR to 38.133 Introducing applicability of requirements for FR2 | vivo | | R4-2202756 | Draft CR adding timing requirements for FR2-2 | Nokia, Nokia Shanghai Bell | | R4-2202757 | Introduction of scheduling restriction for FR2-2 | MediaTek Inc | | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | |  |  |  | | --- | --- | --- | | Index of change | Clause impacted | Endorsed CRs | | #1 | 3.6.11 | R4-2202755 | | #2 | 7.3 | R4-2202756 | | #3 | 7.5.4 | R4-2202048 | | #4 | 7.5.6 | R4-2202048 | | #5 | 7.6.4 | R4-2202048 | | #6 | 7.6.6 | R4-2202048 | | #7 | 7.7.1 | R4-2202048 | | #8 | 8.2.2 | R4-2202661 | | #9 | 8.2.4 | R4-2202661 | | #10 | 8.6.1, 8.6.2, 8.6.2A | R4-2201198 | | #11 | 9.1.2 | R4-2202663 | | #12 | 9.2.5.3.3 | R4-2202757 |   . | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | No requirements for FR2-2 will be specified | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.6.11, 7.3, 7.5.4, 7.5.6, 7.6.4, 7.6.6, 7.7.1, 8.2.2, 8.2.4, 8.6, 9.1.2, 9.2.5.3.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

## <Start of Change 1 (R4-2202755)>

### 3.6.11 Applicability of requirements for FR2

Unless stated otherwise, the requirements for FR2 are applicable to both FR2-1 and FR2-2, except for the following cases:

SFTD measurement requirements in clause 9.2.5.4, 9.3.8, 10.1.21 for FR2 are only applicable for FR2-1,

CGI identification requirements in clause 9.11 for FR2 are only applicable for FR2-1,

Inter-band CA requirements in all corresponding clauses for FR2 are only applicable for FR2-1.

<End of Change 1>

<Start of Change 2 (R4-2202756)>

### 7.3.1 Introduction

The timing advance is initiated from gNB to UE in EN-DC, NR-DC, NE-DC and NR SA operation modes, with MAC message that implies the adjustment of the timing advance, as defined in clause 5.2 of TS 38.321 [7].

### 7.3.2 Requirements

#### 7.3.2.1 Timing Advance adjustment delay

UE shall adjust the timing of its uplink transmission timing at time slot *n*+ *k+1* for a timing advance command received in time slot *n*, and the value of *k* is defined in clause 4.2 in TS 38.213 [3]. The same requirement applies also when the UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

#### 7.3.2.2 Timing Advance adjustment accuracy

The UE shall adjust the timing of its transmissions with a relative accuracy better than or equal to the UE Timing Advance adjustment accuracy requirement in Table 7.3.2.2-1, to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command step is defined in TS 38.213 [3].

Table 7.3.2.2-1: UE Timing Advance adjustment accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| UL Sub Carrier Spacing(kHz) | 15 | 30 | 60 | 120 | 480 | 960 |
| UE Timing Advance adjustment accuracy | ±256 Tc | ±256 Tc | ±128 Tc | ±32 Tc | [±8 Tc] | [±4 Tc] |

*Editor’s note: Revisit if certain implementation issues are identified.*

<End of Change 2>

<Start of Change 3 (R4-2202048)>

7.5.4 Minimum Requirements for NR Carrier Aggregation

The UE shall be capable of handling at least a relative transmission timing difference between slot timing of all pairs of TAGs as shown in Table 7.5.4-1, provided that the UE is:

- configured with the pTAG and the sTAG for inter-band NR carrier aggregation in SA or NR-DC mode, or

- configured with more than one sTAG for inter-band NR carrier aggregation in EN-DC or NE-DC mode.

**Table 7.5.4-1: Maximum uplink transmission timing difference requirement for inter-band NR carrier aggregation**

|  |  |
| --- | --- |
| **Frequency Range of the pair of TAGs** | **Maximum uplink transmission timing difference (µs)** |
| FR1 | 34.6 |
| FR2-1 | 8.5 Note1 |
| Between FR1 and FR2-1 | 26.1 |
| Between FR1 and FR2-2 | TBD |
| Note1: This requirement applies to the UE capable of independent beam management for FR2-1 inter-band CA. | |

<End of Change 3>

<Start of Change 4 (R4-2202048)>

### 7.5.6 Minimum Requirements for inter-band NR DC

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and PSCell as shown in Table 7.5.6-1 provided that the UE indicates that it is capable of synchronous NR DC only [14].

Table 7.5.6-1: Maximum uplink transmission timing difference requirement for inter-band synchronous NR DC

|  |  |  |
| --- | --- | --- |
| Frequency Range | | Maximum uplink transmission timing difference (µs) |
| Cell in MCG | Cell in SCG |  |
| FR1 | FR1 | 34.6 |
| FR2-1 | FR2-1 | 8.5 |
| FR1 | FR2-1 | 34.1 |
| FR1 | FR2-2 | TBD |

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and PSCell as shown in Table 7.5.6-2 provided that the UE indicates that it is capable of asynchronous NR DC [14].

Table 7.5.6-2 Maximum uplink transmission timing difference requirement for inter-band asynchronous NR DC

|  |  |
| --- | --- |
| Max {Sub-carrier spacing in PCell (kHz), Sub-carrier spacing in PSCell (kHz)} | Maximum uplink transmission timing difference (µs) |
| 15 | 500 |
| 30 | 250 |
| 60 | 125 |
| 120 | 62.5 |
| 480 | 15.625 |
| 960 | 7.8125 |

<End of Change 4>

<Start of Change 5 (R4-2202048)>

### 7.6.4 Minimum Requirements for NR Carrier Aggregation

For intra-band CA, only co-located deployment is applied. For intra-band non-contiguous NR carrier aggregation, the UE shall be capable of handling at least a relative receive timing difference between slot timing of different carriers to be aggregated at the UE receiver as shown in Table 7.6.4-1 below.

Table 7.6.4-1: Maximum receive timing difference requirement for intra-band non-contiguous NR carrier aggregation

|  |  |
| --- | --- |
| Frequency Range | Maximum receive timing difference (µs) |
| FR1 | 31 |
| FR2-1 | 0.26 |
| FR2-2 | TBD |
| Note 1: In the case of different SCS on different CCs, if the receive time difference exceeds the cyclic prefix length of that SCS, demodulation performance degradation is expected for the first symbol of the slot. | |

For inter-band NR carrier aggregation, the UE shall be capable of handling at least a relative receive timing difference between slot timing of all pairs of carriers to be aggregated at the UE receiver as shown in Table 7.6.4-2 below.

Table 7.6.4-2: Maximum receive timing difference requirement for inter-band NR carrier aggregation

|  |  |
| --- | --- |
| Frequency Range of the pair of carriers | Maximum receive timing difference (µs) |
| FR1 | 33 |
| FR2-1 | 8 note1 |
| Between FR1 and FR2-1 | 25 |
| Between FR1 and FR2-2 | TBD |
| Note1: This requirement applies to the UE capable of independent beam management for FR2-1 inter-band CA. | |

<End of Change 5>

<Start of Change 6 (R4-2202048)>

### 7.6.6 Minimum Requirements for inter-band NR DC

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG at the UE receiver as shown in Table 7.6.6-1 provided that the UE indicates that it is capable of synchronous NR DC only [16].

Table 7.6.6-1: Maximum receive timing difference requirement for inter-band synchronous NR DC

|  |  |  |
| --- | --- | --- |
| Frequency Range | | Maximum receive timing difference (µs) |
| Cell in MCG | Cell in SCG |  |
| FR1 | FR1 | 33 |
| FR2-1 | FR2-1 | 8 |
| FR1 | FR2-1 | 33 |
| FR1 | FR2-2 | TBD |

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG at the UE receiver as shown in Table 7.6.6-2 provided that the UE indicates that it is capable of asynchronous NR DC [16].

Table 7.6.6-2 Maximum receive timing difference requirement for inter-band asynchronous NR DC

|  |  |
| --- | --- |
| Max {Sub-carrier spacing in PCell (kHz), Sub-carrier spacing in PSCell (kHz)} | Maximum receive timing difference (µs) |
| 15 | 500 |
| 30 | 250 |
| 60 | 125 |
| 120 | 62.5 |
| 480 | 15.625 |
| 960 | 7.8125 |

<End of Change 6>

<Start of Change 7 (R4-2202048)>

### 7.7.1 Minimum requirements

When *deriveSSB-IndexFromCell* is enabled, the UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the same frequency carrier is within a tolerance not worse than

* min (2 SSB symbols, 1 PDSCH symbol) for sub-carrier spacings up-to 240 kHz,
* min (TBD SSB symbols, TBD PDSCH symbol) for sub-carrier spacing of 480 kHz and
* min (TBD SSB symbols, TBD PDSCH symbol) for sub-carrier spacing of 960 kHz

and the SFNs of all cells on the same frequency carrier are the same.

<End of Change 7>

<Start of Change 8 (R4-2202661)>

### 8.2.2 SA: Interruptions with Standalone NR Carrier Aggregation

#### 8.2.2.1 Introduction

This clause contains the requirements related to the interruptions on PCell and activated SCell if configured, when

up to 7 SCells are configured, de-configured, activated or deactivated, or

a supplementary UL carrier or an UL carrier is configured or de-configured, or

measurements on SCC with deactivated SCell in NR SCG, or

UL/DL BWP is switched on PCell or SCell, or

CGI reading of an NR neighbour cell with autonomous gaps, or

CGI reading of an E-UTRA neighbour cell with autonomous gaps.

UE-specific CBW is changed on PCell or SCell, or

NR SRS carrier based switching, or

UE dynamic Tx switches between two uplink carriers.

Note: interruptions at SCell addition/release, activation/deactivation and during measurements on SCC may not be required by all UEs.

The interruptions shall not interrupt RRC signalling or ACK/NACKs related to RRC reconfiguration procedure according to TS38.331 [2] for SCell addition/release or MAC control signalling according to TS37.340 [17] for SCell activation/deactivation command.

This clause additionally contains requirements related to interruptions at inter-frequency SFTD between PCell in FR1 and neighbour cell in FR2.

For a UE which does not support per-FR measurement gap, interruptions to the PCell and activated SCell may be caused by SCells on any frequency range. For a UE which supports per-FR gaps, interruptions to PCell and activated SCell may be caused by SCells on the same frequency range as the victim cell.

In addition to standalone NR carrier aggregation when no CCA is configured, the requirements in clause 8.2.2. and all subclauses of 8.2.2 apply when the UE is configured with

-A PCell not using CCA in downlink and one or more SCells using CCA in downlink or

-A PCell and one or more SCells using CCA in downlink

#### 8.2.2.2 Requirements

##### 8.2.2.2.1 Interruptions at SCell addition/release

When any number of SCells between one and 7 is added or released using the same *RRCConnectionReconfiguration* message as defined in TS 38.331 [2], the UE is allowed an interruption on any active serving cell during the RRC reconfiguration procedure as follows:

- an interruption on any active serving cell:

- of up to X1 slot, if the active serving cell and the SCell being added or released are in a FR1 band pair or in a FR1+FR2 band pair.

- of up to X1 slot, if the active serving cell and the SCell being added or released are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.

Where X1 is specified in Table 8.2.2.2.1-1.

or

- of up to the duration shown in table 8.2.2.2.1-2, if the active serving cells are in the same band as any of the SCells being added or released, provided the cell specific reference signals from the active serving cells and the SCells being added or released are available in the same slot.

Table 8.2.2.2.1-1: Interruption length X1 for SCell addition/release for inter-band CA

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) of victim cell | Interruption length X1 (slots) | |
| 0 | 1 | 1 | |
| 1 | 0.5 | 2 | |
| 2 | 0.25 | Both aggressor cell and victim cell are on FR2 | 4 |
|  |  | Either aggressor cell or victim cell is on FR1 | 5 |
| 3 | 0.125 | Aggressor cell is on FR2 | 8 |
|  |  | Aggressor cell is on FR1 | 9 |
|  |
| 5 | 0.03125 | Aggressor cell is on FR1 | 33 |
| 6 | 0.015625 | Aggressor cell is on FR1 | 65 |

Table 8.2.2.2.1-2: Interruption duration for SCell addition/release for intra-band CA

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length (slots) |
| 0 | 1 | 1 + TSMTC\_duration \* |
| 1 | 0.5 | 2 + TSMTC\_duration \* |
| 2 | 0.25 | 4 + TSMTC\_duration \* |
| 3 | 0.125 | 8 + TSMTC\_duration \* |
| 5 | 0.03125 | 32+ TSMTC\_duration \* |
| 6 | 0.015625 | 64+ TSMTC\_duration \* |
| NOTE 1: TSMTC\_duration measured in subframes is  - the longest SMTC duration among all above active serving cells and the SCell being added when one SCell is added;  - the longest SMTC duration among all active serving cells in the same band when one SCell is released.  NOTE 2: is as defined in TS 38.211 [6]. | | |

##### 8.2.2.2.2 Interruptions at SCell activation/deactivation

When an intra-band SCell is activated or deactivated as defined in TS 37.340 [17], the UE is allowed

- an interruption on any active serving cell:

- of up to X2 slot, if the active serving cell and the SCell being activated or deactivated are in a FR1 band pair or in a FR1+FR2 band pair.

- of up to X2 slot, if the active serving cell and the SCell being activated or deactivated are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.

Where X2 is specified in Table 8.2.2.2.2-1.

or

- of up to the duration shown in table 8.2.2.2.2-2, if the active serving cells are in the same band as any of the SCells being activated or deactivated provided the cell specific reference signals from the active serving cells and the SCells being activated or deactivated are available in the same slot.

Table 8.2.2.2.2-1: Interruption length X2 for SCell activation/deactivation for inter-band CA

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) of victim cell | Interruption length X2 (slots) | |
| 0 | 1 |  | 1 |
| 1 | 0.5 |  | 1 |
| 2 | 0.25 | Both aggressor cell and victim cell are on FR2 | 2 |
|  |  | Either aggressor cell or victim cell is on FR1 | 3 |
| 3 | 0.125 | Aggressor cell is on FR2 | 4 |
|  |  | Aggressor cell is on FR1 | 5 |
| 5 | 0.03125 | Aggressor cell is on FR1 | 17 |
| 6 | 0.015625 | Aggressor cell is on FR1 | 33 |

Table 8.2.2.2.2-2: Interruption duration for SCell activation/deactivation for intra-band CA

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length (slots) |
| 0 | 1 | 1 + TSMTC\_duration \* |
| 1 | 0.5 | 1 + TSMTC\_duration \* |
| 2 | 0.25 | 2 + TSMTC\_duration \* |
| 3 | 0.125 | 4 + TSMTC\_duration \* |
| 5 | 0.03125 | 16+ TSMTC\_duration \* |
| 6 | 0.015625 | 32+ TSMTC\_duration \* |
| NOTE 1: TSMTC\_duration measured in subframes is  - the longest SMTC duration among all above active serving cells and the SCell being activated when one SCell is activated;  - the longest SMTC duration among all active serving cells in the same band when one SCell is deactivated.  NOTE 2: is as defined in TS 38.211 [6]. | | |

##### 8.2.2.2.3 Interruptions during measurements on deactivated SCC

Interruptions on PCell or activated SCell(s) due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer.

* If the PCell or activated SCell(s) is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on PCell or activated SCell(s) immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 8.2.2.2.2-1.

If the PCell or activated SCell(s) is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on PCell or activated SCell(s) no earlier than X slots before TSMTC\_duration and no later than X slots after TSMTC\_duration, provided the cell specific reference signals from the active serving cells and the deactivated SCell are available in the same slot, where X and TSMTC\_duration are given by Table 8.2.2.2.3-1. The interruption shall not exceed requirements in Table 8.2.2.2.3-1.

Table 8.2.2.2.3-1: Interruption duration for measurement on deactivated SCell for intra-band CA

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | X (slots) | Interruption length (slots) |
| 0 | 1 | 1 | 2 + TSMTC\_duration \* |
| 1 | 0.5 | 1 | 2 + TSMTC\_duration \* |
| 2 | 0.25 | 2 | 4 + TSMTC\_duration \* |
| 3 | 0.125 | 4 | 8 + TSMTC\_duration \* |
| 5 | 0.03125 | 16 | 32 + TSMTC\_duration \* |
| 6 | 0.015625 | 32 | 64 + TSMTC\_duration \* |
| NOTE 1: TSMTC\_duration measured in subframes is the longest SMTC duration among all above active serving cells and the deactivated SCell to be measured;  NOTE 2: is as defined in TS 38.211 [6]. | | | |

##### 8.2.2.2.4 Interruptions at UL carrier RRC reconfiguration

The requirements in this clause shall apply when a supplementary UL carrier or an UL carrier is configured or de-configured in NR standalone carrier aggregation as defined in TS 38.331 [2].

When an UL carrier or supplementary UL carrier is configured or de-configured, an interruption of up to the duration shown in table 8.2.2.2.4-1, is allowed during the RRC reconfiguration procedure [2] on PCell and all activated SCells within the same FR as the reconfigured uplink carrier. The interruption is for both uplink and downlink of PCell and all the activated SCells within the same FR as the configured or de-configured UL.

Table 8.2.2.2.4-1: Interruption duration for UL carrier RRC reconfiguration

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length (slots) |
| 0 | 1 | 1 |
| 1 | 0.5 | 2 |
| 2 | 0.25 | 4 |
| 3 | 0.125 | 8 |
| 5 | 0.03125 | 32 |
| 6 | 0.015625 | 64 |

##### 8.2.2.2.5 Interruptions due to Active BWP switching Requirement

The requirements for DCI-based BWP switch, timer-based BWP switch or UL BWP switch triggered by consistent uplink CCA failures in this clause apply to the case that the BWP switch is performed on a single CC or multiple CCs.

When either of the DCI-based, timer-based or RRC-based downlink BWP switch and/or uplink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this clause apply for each BWP switch.

When UE receives a DCI indicating UE to switch its active BWP involving changes in any of the parameters listed in Table 8.2.2.2.5-2, the UE is allowed to cause interruption of up to X slot to other active serving cells if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 8.2.2.2.5-2 and the UE is capable of per-FR gap the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 8.2.2.2.5-1. The starting time of interruption is only allowed within the BWP switching delay TBWPswitchDelay as defined in clause 8.6.2 when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay TMultipleBWPswitchDelay +Y as defined in clause 8.6.2A.1 when BWP switch occurs on multiple CCs. Interruptions are not allowed during BWP switch involving any other parameter change.

When a BWP timer *bwp-InactivityTimer* defined in TS 38.331 [2] expires, UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in Table 8.2.2.2.5-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 8.2.2.2.5-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 8.2.2.2.5-1. The starting time of interruption is only allowed within the BWP switching delay TBWPswitchDelay as defined in clause 8.6.2 when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay TMultipleBWPswitchDelay as defined in clause 8.6.2B.1 when BWP switch occurs on multiple CCs simultaneously or TMultipleBWPswitchDelayTotal as defined in clause 8.6.2B.2 when BWP switch occurs on multiple CCs over partially overlapping time period. Interruptions are not allowed during BWP switch involving any other parameter change.

When UE receives an RRC reconfiguration that only requests UE to switch its active BWP on one single CC, the UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in Table 8.2.2.2.5-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 8.2.2.2.5-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 8.2.2.2.5-1. The interruption is only allowed within the delay TRRCprocessingDelay + TBWPswitchDelayRRC defined in clause 8.6.3 when BWP switch occurs on a single CC. The interruption is only allowed within the delay TRRCprocessingDelay + TBWPswitchDelayRRC + DRRC\*(N-1) as defined in clause 8.6.3A when BWP switch occurs on multiple CCs.

When UL BWP switch is triggered by consistent uplink CCA failures [7], UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its active UL BWP involving changes in any of the parameters listed in Table 8.2.2.2.5-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the UL BWP switch imposes changes in any of the parameters listed in Table 8.2.2.2.5-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing UL BWP switching. X is defined in Table 8.2.2.2.5-1. The starting time of interruption is only allowed within the UL BWP switching delay TBWPswitchDelay as defined in clause 8.6.2. Interruptions are not allowed during BWP switch involving other parameter change.

Table 8.2.2.2.5-1: Interruption length X

|  |  |  |
| --- | --- | --- |
|  | NR Slot | Interruption length X (slots) |
|  | length (ms) |  |
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |
| 2 | 0.25 | 3 |
| 3 | 0.125 | 5 |
| 5 | 0.03125 | 17 |
| 6 | 0.015625 | 33 |
| Note1: void | | |

Table 8.2.2.2.5-2: Parameters which cause interruption other than SCS

|  |  |
| --- | --- |
| Parameters | Comment |
| *locationAndBandwidth* | From TS 38.331 [2] |
| *nrofSRS-Ports* |  |
| *maxMIMO-Layers-r16* |  |

##### 8.2.2.2.6 Interruptions at inter-frequency SFTD measurement

The requirements in this clause concern interruptions on PCell, as well as on activated SCells in MCG, when the UE is performing SFTD measurements on inter-frequency neighbour cell(s). The following requirements apply when no PSCell is configured.

For a UE with per-FR gap capability:

- for neighbour cell in FR1:

- the percentage of interrupted slots on uplink and downlink on FR1 serving cells during the SFTD measurement period Tmeasure\_SFTD1 specified in Clause 9.3.8 shall not exceed the percentages specified in Table 8.2.2.2.6-1. No interruption is allowed on FR2 serving cells.

- the length of each interruption on FR1 serving cells shall not exceed the number of slots specified in Table 8.2.2.2.6-2.

- for neighbour cell in FR2:

- the percentage of interrupted slots on uplink and downlink on FR2 serving cells during the SFTD measurement period Tmeasure\_SFTD1 specified in Clause 9.3.8 shall not exceed the percentages specified in Table 8.2.2.2.6-1. No interruption is allowed on FR1 serving cells.

- the length of each interruption on FR2 serving cells shall not exceed the number of slots specified in Table 8.2.2.2.6-2.

For a UE with per-UE gap capability:

- for neighbour cell in FR1 or FR2:

- the percentage of interrupted slots on uplink and downlink on FR1 and FR2 serving cells during the SFTD measurement period Tmeasure\_SFTD1 specified in Clause 9.3.8 shall not exceed the percentages specified in Table 8.2.2.2.6-1.

- the length of each interruption on FR1 and FR2 serving cells shall not exceed the number of slots specified in Table 8.2.2.2.6-2.

Table 8.2.2.2.6-1: Requirements on maximum percentage of interrupted slots in serving cell in inter-frequency SFTD

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SFTD configuration | Serving cell µ | Neighbour cell SMTC periodicity | | | | | |
|  |  | 5ms | 10ms | 20ms | 40ms | 80ms | 160ms |
| With RSRP | 0 | 8.4% | 6.3% | 8.4% | 6.3% | 5.3% | 4.7% |
| report | 1 |  |  |  |  |  |  |
|  | 2 |  |  |  |  |  |  |
|  | 3 |  |  |  |  |  |  |
| Without RSRP | 0 | 11.4% | 8.6% | 7.9% | 6.8% | 6.3% | 6.0% |
| report | 1 |  |  |  |  |  |  |
|  | 2 |  |  |  |  |  |  |
|  | 3 |  |  |  |  |  |  |

Table 8.2.2.2.6-2: Interruption duration for FR1 serving cell in inter-frequency SFTD with neighbour cell in FR1

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length (slots) |
| 0 | 1 | 1 |
| 1 | 0.5 | 2 |
| 2 | 0.25 | 4 |
| 3 | 0.125 | 8 |

Table 8.2.2.2.6-3: Void

Table 8.2.2.2.6-4: Void

##### 8.2.2.2.7 Interruptions at SCell activation/deactivation with multiple downlink SCells

The requirements in this clause shall apply for the UE configured with PCell and up to 7 downlink SCell(s).

When multiple SCell is activated or deactivated by one single MAC CE command:

- an interruption on any active serving cell is specified as in clause 8.2.2.2.2:

##### 8.2.2.2.8 Interruptions due to UE-specific CBW change

When UE receives an RRC reconfiguration that changes *offsetToCarrier* or *carrierBandwidth*, the UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its CBW. X is defined in Table 8.2.2.2.8-1. The interruption is only allowed within the delay TRRCprocessingDelay + TCBWchangeDelayRRC defined in clause 8.7.

Table 8.2.2.2.8-1: interruption length X

|  |  |  |
| --- | --- | --- |
|  | NR Slot | Interruption length X (slots) |
|  | length (ms) |  |
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |
| 2 | 0.25 | 3 |
| 3 | 0.125 | 5 |
| 5 | 0.03125 | 17 |
| 6 | 0.015625 | 33 |

##### 8.2.2.2.9 Interruptions at NR SRS carrier based switching

SRS transmission can be configured on a carrier not configured for PUCCH/PUSCH transmission. When a UE needs to transmit periodic, semi-persistent or aperiodic SRS on a carrier of a serving cell not configured for PUCCH/PUSCH transmission, the UE can perform carrier based switching to one or more carriers not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission or from a carrier not configured for PUCCH/PUSCH transmission prior to transmitting SRS, provided that:

- switching is from a configured carrier to another activated carrier;

- the carrier of SCells not configured for PUCCH/PUSCH transmission to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission, or indicated by MAC-CE for semi-persistent SRS transmission, or configured via RRC for periodic SRS transmission;

- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex and srs-SwitchFromCarrier in TS38.331 [2];

- the SRS switching is not colliding with any other transmission with higher priority defined in TS 38.214 [26].

- the SRS switching is not colliding with any SSB/CSI-RS based L3 measurements and the measurements for RLM/BFD.

- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [2], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101-1 [18] for frequency range 1 and TS 38.101-2 [19] for frequency range 2, the SRS transmission are not simultaneously scheduled with DL SSB/CSI-RS for L3 or L1 measurements transmission on other carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR1 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 8.2.2.2.9-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR2 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 8.2.2.2.9-2.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR1 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 8.2.2.2.9-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR2 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 8.2.2.2.9-2.

Table 8.2.2.2.9-1: Interruption length X1 (slot)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NR Slot length | SRS carrier | Interruption length X1 (slots) | |
|  | (ms) of victim cell | switching time (us)Note 1 | Sub carrier spacing for agressor cell (kHz) | |
|  |  |  | 15 | 30 |
| 0 | 1 | ≤ 200 | 2 | 2 |
|  |  | 300, 500 | 2 | 2 |
|  |  | 900 | 2 | 2 |
| 1 | 0.5 | ≤ 200 | 3 | 2 |
|  |  | 300, 500 | 3 | 3 |
|  |  | 900 | 4 | 4 |
| 2 | 0.25 | ≤ 200 | 4 | 3 |
|  |  | 300, 500 | 5 | 4 |
|  |  | 900 | 7 | 6 |
| 3 | 0.125 | ≤ 200 | 7 | 5 |
|  |  | 300, 500 | 9 | 7 |
|  |  | 900 | 12 | 10 |
| 5 | 0.03125 | ≤ 200 | 22 | 15 |
| 300, 500 | 31 | 24 |
| 900 | 44 | 37 |
| 6 | 0.015625 | ≤ 200 | 42 | 28 |
| 300, 500 | 61 | 47 |
| 900 | 87 | 73 |
| Note1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*. | | | | |

Table 8.2.2.2.9-2: Interruption length X2 (slot)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | NR Slot | SRS carrier | Interruption length X2 (slots) | | | |
|  | length (ms) of victim cell | switching time (us) Note 1 | Sub carrier spacing for agressor cell (kHz) | | | |
|  |  |  | 60 | 120 | 480 | 960 |
| 0 | 1 | ≤ 200 | 2 | 2 | 2 | 2 |
| 1 | 0.5 | ≤ 200 | 2 | 2 | 2 | 2 |
| 2 | 0.25 | ≤ 200 | 3 | 3 | 2 | 2 |
| 3 | 0.125 | ≤ 200 | 4 | 4 | 3 | 3 |
| 5 | 0.03125 | ≤ 200 | 11 | 10 | 8 | 8 |
| 6 | 0.015625 | ≤ 200 | 21 | 18 | 15 | 15 |
| Note1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*. | | | | | | |

For intra-band SRS carrier switching in FR1 or FR2, interruptions in Table 8.2.2.2.9-1 and in Table 8.2.2.2.9-2 based on SRS carrier switching time ≤ 200us shall apply. For inter-band SRS carrier switching in FR1, interruptions in Table 8.2.2.2.9-1 and in Table 8.2.2.2.9-2 shall apply.

##### 8.2.2.2.10 DL Interruptions at UE switching between two uplink carriers

The DL interruption requirements at dynamic switching between two uplink carreirs specified in this clause are applicable for an uplink band pair of an inter-band UL CA configuration when the capability *uplinkTxSwitchingPeriod* is present, and is only applicable for uplink switching mechanism specified in clause 6.1.6 of TS 38.214 [26], where NR uplink carrier 1 is capable of one transmit antenna connector and NR uplink carrier 2 is capable of two transmit antenna connectors, and the two uplink carriers are in different bands with different carrier frequencies.

When dynamic switching between two uplink carriers is conducted, UE is allowed to cause DL interruption of X OFDM symbols in NR downlink carrier(s) as indicated by *uplinkTxSwitching-DL-Interruption* [2]. The DL interruption starts from the first OFDM symbol which fully or partially overlaps with the UL switching period located in either NR carrier 1 or carrier 2 as indicated in RRC signalling [2]. The DL interruption lengths of X are defined in Table 8.2.2.2.10-1.

No DL interruption is allowed in the NR downlink carrier(s) which is not indicated by *uplinkTxSwitching-DL-Interruption*. No DL interruption is allowed for some inter-band UL CA configurations as specified in clause 5.2A.2 of TS 38.101-1 [18].

Table 8.2.2.2.10-1: DL interruption length on NR carrier(s) in the unit of OFDM symbols (X) for switching between two uplink carriers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NR Slot length (ms) | Uplink Tx switching period Note1 | | |
|  |  | 35us | 140us | 210us |
| 0 | 1 | 2 | 3 | 4 |
| 1 | 0.5 | 3 | 6 | 7 |
| 2 | 0.25 | 4 | 10 | 14 |
| Note 1: Uplink Tx switching period depends on UE capability *uplinkTxSwitchingPeriod* | | | | |

##### 8.2.2.2.11 Interruptions at direct SCell activation

When one or multiple SCell(s) are directly activated at SCell addition,

- the UE is allowed an interruption on any active serving cell:

- of up to the duration shown in Table 8.2.2.2.1-1, if the active serving cell is not in the same band as the SCell being directly activated, or

- of up to the duration shown in Table 8.2.2.2.1-2, if the active serving cells are in the same band as the SCell being activated provided the cell specific reference signals from the active serving cells and the SCell being activated are available in the same slot.

##### 8.2.2.2.12 Interruptions due to SCell dormancy

8.2.2.2.12.1 Interruptions due to SCell dormancy switch

When one SCell in MCG is switched from dormancy to non-dormancy or from non-dormancy to dormancy [7] when UE is in DRX active time,

- the UE is allowed an interruption on active serving cell in MCG as defined in clause 8.2.2.2.5, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP

- The starting time of interruption shall be within the dormancy switching delay as defined in clause 8.6.2.

When multiple SCells in MCG are switched from dormancy to non-dormancy or vice versa when the UE is in DRX active time, the interruption requirement described above applies for each BWP switch.

8.2.2.2.12.2 Interruptions due to CQI measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of CQI measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from CQI measurements on dormant SCells shall not exceed 0.5%.

8.2.2.2.12.3 Interruptions due to RRM measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of RRM measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from RRM measurements on dormant SCells shall not exceed 1.0%.

##### 8.2.2.2.13 Interruptions at transitions between active and non-active during DRX

For the UEs that are capable of *secondaryDRX-Group*[14] in FR1+FR2 CA, when two DRX groups are configured each group of serving cells, no interruption is allowed for UEs supporting either per UE or per FR gaps.

##### 8.2.2.2.14 Interruptions when identifying CGI of an NR cell with autonomous gaps

When a UE is identifying CGI of an NR cell with autonomous gaps, the UE is allowed interruptions on PCell or any activated SCell:

- with up to K1 interruptions with interrupted slots up to interruption length X1 specified in Table 8.2.2.2.14-1 for each interruption during MIB decoding time period TMIB (ms) specified in clause 9.11.

- with up to L1 interruptions with interrupted slots up to interruption length Y1 specified in Table 8.2.2.2.14-1 during SIB1 decoding time period TSIB1 (ms) specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 1.

- with up to L2 interruptions with interrupted slots up to interruption length Y2 specified in Table 8.2.2.2.14-1 during SIB1 decoding time period TSIB1 (ms) specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3.

Where:

- K1 = 6 for the target cell carrier frequency on FR1 and K1 = 25 for the target cell carrier frequency on FR2, and

- L1 = TSIB1/20and

- L2 = TSIB1/TSMTC, where TSMTC is the periodicity of the SMTC occasion configured for the target cell carrier.

Table 8.2.2.2.14-1: Interruption length X1, Y1 and Y2 during measurements with autonomous gaps

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NR Slot length (ms) of victim cell | Interruption length X1 (slots) | Interruption length Y1 (slots) | Interruption length Y2 (slots) |
| 0 | 1 | 6 | 7 | 6 |
| 1 | 0.5 | 12 | 13 | 10 |
| 2 | 0.25 | 24 | 25 | 19 |
| 3 | 0.125 | 48 | 49 | 37 |

##### 8.2.2.2.15 Interruptions when identifying CGI of an E-UTRA cell with autonomous gaps

When a UE is identifying CGI of an E-UTRA FDD cell or E-UTRA TDD cell with autonomous gaps, within time period Tidentify\_CGI, E-UTRA specified in clause 9.4.7.1, the UE shall be able to transmit at least the number of ACK/NACKs specified in Table 8.2.2.2.15-1 on PCell or any activated SCell in the frequency range where autonomous gaps are used, provided that:

- there is continuous DL data allocation,

- no DRX cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each slot,

- 2 slot ACK/NACK feedback is configured,

- 20 ms SMTC period is configured.

Table 8.2.2.2.15-1: Minimum number of ACK/NACKs transmitted by the UE during Tidentify\_CGI, E-UTRA

|  |  |  |
| --- | --- | --- |
| Minimum number of transmitted ACK/NACKs | SCS | |
|  | Duplex mode configuration | SCS |
|  | Duplex mode configuration | SCS |
| 84 | FDD | 15 kHz |
| 193 | FDD | 30 kHz |
| 402 | FDD | 60 kHz |
| 28 | TDD Note 1 | 15 kHz |
| 81 | TDD Note 1 | 30 kHz |
| 159 | TDD Note 1 | 60 kHz |
| 233 | TDD Note 2 | 60 kHz |
| 491 | TDD Note 2 | 120 kHz |
| NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18].  NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19]. | | |

<End of Change 8>

<Start of Change 9 (R4-2202661)>

### 8.2.4 NR-DC: Interruptions

#### 8.2.4.1 Introduction

This clause contains the requirements related to the interruptions on PCell, PSCell and activated SCell if configured, when

up to 1 SCell in FR1 and up to 7 SCell(s) in FR2 are configured, deconfigured, activated or deactivated or,

a supplementary UL carrier or an UL carrier is configured or de-configured, or

measurements on SCC with deactivated SCell in NR SCG, or

UL/DL BWP is switched on PCell, PSCell or SCell.

transitions between active and non-active during DRX, or

transitions from non-DRX to DRX, or

CGI reading of an NR neighbour cell with autonomous gaps, or

CGI reading of an E-UTRA neighbour cell with autonomous gaps.

NR SRS carrier based switching.

Note: interruptions at SCell addition/release, activation/deactivation and during measurements on SCC may not be required by all UEs.

The interruptions shall not interrupt RRC signalling or ACK/NACKs related to RRC reconfiguration procedure [2] for SCell addition/release or MAC control signalling [17] for SCell activation/deactivation command.

The requirements shall apply for NR-DC with an NR PCell, PSCell or SCell.

For a UE which does not support per-FR measurement gap, interruptions to the PCell and activated SCell may be caused by SCells on any frequency range. For a UE which supports per-FR gaps, interruptions to PCell, PSCell and activated SCell may be caused by SCells on the same frequency range as the victim cell.

#### 8.2.4.2 Requirements

##### 8.2.4.2.1 Interruptions at PSCell/SCell addition/release

When PSCell or one or more SCells is added or released using the same *RRCConnectionReconfiguration* message as defined in TS 38.331 [2], the UE is allowed an interruption on any activated serving cell during the RRC reconfiguration procedure as follows:

- an interruption on any active serving cell:

- of up to the duration shown in table 8.2.4.2.1-1, if the active serving cell is not in the same band as any of the PSCell or SCells being added or released, where the requriements for Sync apply for synchronous NR-DC, and for asynchronous NR-DC if the active serving cell is in the same CG as all of the PSCell and SCells being added or released, and the requriements for Async apply for asynchronous NR-DC if the active serving cell is not in the same CG as any of the PSCell or SCells being added or released, or

- of up to the duration shown in table 8.2.4.2.1-2, if the active serving cells are in the same band as any of the SCells being added or released, provided the cell specific reference signals from the active serving cells and the SCells being added or released are available in the same slot.

Table 8.2.4.2.1-1: Interruption duration for PSCell/SCell addition/release for inter-band DC/CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NR Slot length (ms) | Interruption length (slots) | | |
|  | of victim cell | Sync | | Async |
| 0 | 1 | 1 | | 2 |
| 1 | 0.5 | 2 | | 3 |
| 2 | 0.25 | Both aggressor cell and victim cell are on FR2 | 4 | 5 |
|  |  | Either aggressor cell or victim cell is on FR1 | 5 |  |
| 3 | 0.125 | Aggressor cell is on FR2 | 8 | 9 |
|  |  | Aggressor cell is on FR1 | 9 |  |
| 5 | 0.03125 | Aggressor cell is on FR1 | 33 | 33 |
| 6 | 0.015625 | Aggressor cell is on FR1 | 65 | 65 |

Table 8.2.4.2.1-2: Interruption duration for SCell addition/release for intra-band DC/CA

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length (slots) |
| 0 | 1 | 1 + TSMTC\_duration \* |
| 1 | 0.5 | 2 + TSMTC\_duration \* |
| 2 | 0.25 | 4 + TSMTC\_duration \* |
| 3 | 0.125 | 8 + TSMTC\_duration \* |
| 5 | 0.03125 | 32+ TSMTC\_duration \* |
| 6 | 0.015625 | 64+ TSMTC\_duration \* |
| NOTE 1: TSMTC\_duration measured in subframes is  - the longest SMTC duration among all above activeserving cells and the SCell being added when one SCell is added;  - the longest SMTC duration among all active serving cells in the same band when one SCell is released.  NOTE 2: is as defined in TS 38.211 [6] | | |

##### 8.2.4.2.2 Interruptions at SCell activation/deactivation

When a SCell is activated or deactivated as defined in TS 37.340 [17], the UE is allowed

- an interruption on any active serving cell:

- of up to the duration shown in table 8.2.4.2.2-1, if the active serving cell is not in the same band as any of the SCells being activated or deactivated, where the requriements for Sync apply for synchronous NR-DC, and for asynchronous NR-DC if the active serving cell is in the same CG as all the SCells being activated, and the requriements for Async apply for asynchronous NR-DC if the active serving cell is not in the same CG as any of the SCells being activated, or

- of up to the duration shown in table 8.2.4.2.2-2, if the active serving cells are in the same band as any of the SCells being activated or deactivated provided the cell specific reference signals from the active serving cells and the SCells being activated or deactivated are available in the same slot.

Table 8.2.4.2.2-1: Interruption duration for SCell activation/deactivation for inter-band DC/CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NR Slot length | Interruption length (slots) | | |
|  | (ms) of victim cell | Sync | | Async |
| 0 | 1 | 1 | | 2 |
| 1 | 0.5 | 1 | | 2 |
| 2 | 0.25 | Both aggressor cell and victim cell are on FR2 | 2 | 3 |
|  |  | Either aggressor cell or victim cell is on FR1 | 3 |  |
| 3 | 0.125 | Aggressor cell is on FR2 | 4 | 5 |
|  |  | Aggressor cell is on FR1 | 5 |  |
| 5 | 0.03125 | Aggressor cell is on FR1 | 17 | 17 |
| 6 | 0.015625 | Aggressor cell is on FR1 | 33 | 33 |

Table 8.2.4.2.2-2: Interruption duration for SCell activation/deactivation for intra-band DC/CA

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length (slots) |
| 0 | 1 | 1 + TSMTC\_duration \* |
| 1 | 0.5 | 1 + TSMTC\_duration \* |
| 2 | 0.25 | 2 + TSMTC\_duration \* |
| 3 | 0.125 | 4 + TSMTC\_duration \* |
| 5 | 0.03125 | 16+ TSMTC\_duration \* |
| 6 | 0.015625 | 32+ TSMTC\_duration \* |
| NOTE 1: TSMTC\_duration measured in subframes is  - the longest SMTC duration among all above active serving cells and the SCell being activated when one SCell is activated;  - the longest SMTC duration among all active serving cells in the same band when one SCell is deactivated.  NOTE 2: is as defined in TS 38.211 [6]. | | |

##### 8.2.4.2.3 Interruptions during measurements on SCC

Interruption on PCell, PSCell and other activated SCell(s) during measurement on the deactivated NR SCC shall meet requirements in clause 8.2.2.2.3, where the term PCell in clause 8.2.2.2.3 shall be deemed to be replaced with SpCell.

##### 8.2.4.2.4 Interruptions at UL carrier RRC reconfiguration

The requirements in this clause shall apply when a supplementary UL carrier or an UL carrier is configured or de-configured in NR-DC as defined in TS 38.331 [2].

When an UL carrier or supplementary UL carrier is configured or de-configured, an interruption of up to the duration shown in table 8.2.4.2.4-1, is allowed during the RRC reconfiguration procedure in TS38.331 [2] on all the other activated serving cells within the same FR as the reconfigured uplink carrier. The interruption is for both uplink and downlink of all the other serving cells within the same FR as the configured or de-configured UL.

Table 8.2.4.2.4-1: Interruption duration for UL carrier RRC reconfiguration

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Interruption length (slots) |
| 0 | 1 | 1 |
| 1 | 0.5 | 2 |
| 2 | 0.25 | 4 |
| 3 | 0.125 | 8 |
| 5 | 0.03125 | 32 |
| 6 | 0.015625 | 64 |

##### 8.2.4.2.5 Interruptions due to Active BWP switching Requirement

The requirements for DCI-based BWP switch, timer-based BWP switch or UL BWP switch triggered by consistent uplink CCA failures in this clause apply to the case that the BWP switch is performed on a single CC or multiple CCs.

When either of the DCI-based, timer-based or RRC-based downlink BWP switch and/or uplink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this clause apply for each BWP switch.

When UE receives a DCI indicating the UE to switch its active BWP, or when a BWP timer bwp-InactivityTimer defined in TS 38.331 [2] expires, or when the UE receives an RRC command indicating the UE to switch its active BWP or when UL BWP switch is triggered by consistent uplink CCA failures,, the UE is allowed to cause an interruption on any other serving cells as defined in clause 8.2.2.2.5. In addition to what is defined in 8.2.2.5, when RRC-based BWP switch occurs on multiple CCs over partially overlapping period, the interruption is only allowed within the delay TRRCprocessingDelay + TWaiting + TBWPswitchDelayRRC + DRRC\*(M-1) as defined in clause 8.6.3A.3. Besides, in asynchronous scenario the UE is allowed an additional interrupt of 1 slot length.

##### 8.2.4.2.6 Interruptions at transitions between active and non-active during DRX

When PCell is in non-DRX and PSCell is in DRX, interruptions on PCell and the activated SCell in MCG if configured due to transitions from active to non-active and from non-active to active during PSCell DRX are allowed with up to 1% probability of missed ACK/NACK when the configured PSCell DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured PSCell DRX cycle is 640 ms or longer. Each interruption shall not exceed X slot as defined in table 8.2.4.2.6-1.

When PSCell is in non-DRX and PCell is in DRX, interruptions on PSCell on the activated SCell in SCG if configured due to transitions from active to non-active and from non-active to active during PCell DRX are allowed with up to 1 % probability of missed ACK/NACK when the configured PCell DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured PCell DRX cycle is 640 ms or longer. Each interruption shall not exceed X slot as defined in table 8.2.4.2.6-1.

Table 8.2.4.2.6-1: Interruption length X at transition between active and non-active during DRX

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | Interruption length X (slots) | |
|  |  | Sync | Async |
| 0 | 1 | 1 | 2 |
| 1 | 0.5 | 1 | 2 |
| 2 | 0.25 | 3 | |
| 3 | 0.125 | 5 | |
| 5 | 0.03125 | 17 | |
| 6 | 0.015625 | 33 | |

When both PCell and PSCell are in DRX, no interruption is allowed.

##### 8.2.4.2.7 Interruptions at transitions from non-DRX to DRX

Interruption on PCell and the activated SCell in MCG if configured due to PSCell transitions from non-DRX to DRX when PCell is in non-DRX shall not exceed X slots as defined in table 8.2.4.2.6-1.

Interruption on PSCell and the activated SCell in SCG if configured due to PCell transitions from non-DRX to DRX when PSCell is in non-DRX shall not exceed X slots as defined in table 8.2.4.2.6-1.

##### 8.2.4.2.8 Interruptions at SCell activation/deactivation with multiple downlink SCells

The requirements in this clause shall apply for the UE configured with NR-DC and up to 1 downlink SCell in FR1 and up to 7 downlink SCell(s) in FR2.

When multiple SCell are activated or deactivated by one single MAC CE command in MCG or SCG:

- an interruption on any serving cell in MCG or SCG is specified as in clause 8.2.4.2.2.

When multiple SCell are activated or deactivated in both MCG and SCG by two MAC CE commands respectively:

- an interruption on any serving cell in MCG is specified as in clause 8.2.4.2.2, and

- an interruption on any serving cell in SCG is specified as in clause 8.2.4.2.2.

##### 8.2.4.2.9 Interruptions at NR SRS carrier based switching

SRS transmission can be configured on a carrier not configured for PUCCH/PUSCH transmission. When a UE needs to transmit periodic, semi-persistent or aperiodic SRS on a carrier of a serving cell not configured for PUCCH/PUSCH transmission, the UE can perform carrier based switching to one or more carriers not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission or from a carrier not configured for PUCCH/PUSCH transmission prior to transmitting SRS, provided that:

- switching is from a configured carrier to another activated carrier;

- the carrier of SCells not configured for PUCCH/PUSCH transmission to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission, or indicated by MAC-CE for semi-persistent SRS transmission, or configured via RRC for periodic SRS transmission;

- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex and srs-SwitchFromCarrier in TS38.331 [2];

- the SRS switching is not colliding with any other transmission with higher priority defined in TS 38.214 [26].

- the SRS switching is not colliding with any SSB/CSI-RS based L3 measurements and the measurements for RLM/BFD in the same CG.- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [2], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101-3 [20], the SRS transmission are not simultaneously scheduled with DL SSB/CSI-RS for L3 or L1 measurements transmission on other carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR1 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 8.2.4.2.9-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR2 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 8.2.4.2.9-2.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR1 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 8.2.4.2.9-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR2 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 8.2.4.2.9-2.

Table 8.2.4.2.9-1: Interruption length X1 (slot)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NR Slot length | SRS carrier | Interruption length X1 (slots) | |
|  | (ms) of victim cell | switching time (us)Note 1 | Sub carrier spacing for agressor cell (kHz) | |
|  |  |  | 15 | 30 |
| 0 | 1 | ≤ 200 | 2 | 2 |
|  |  | 300, 500 | 2 | 2 |
|  |  | 900 | 3 | 3 |
| 1 | 0.5 | ≤ 200 | 3 | 2 |
|  |  | 300, 500 | 3 | 3 |
|  |  | 900 | 4 | 4 |
| 2 | 0.25 | ≤ 200 | 4 | 3 |
|  |  | 300, 500 | 5 | 4 |
|  |  | 900 | 7 | 6 |
| 3 | 0.125 | ≤ 200 | 7 | 5 |
|  |  | 300, 500 | 9 | 7 |
|  |  | 900 | 12 | 10 |
| 5 | 0.03125 | ≤ 200 | 22 | 15 |
| 300, 500 | 31 | 24 |
| 900 | 44 | 37 |
| 6 | 0.015625 | ≤ 200 | 42 | 28 |
| 300, 500 | 61 | 47 |
| 900 | 87 | 73 |
| Note1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*. | | | | |

Table 8.2.4.2.9-2: Interruption length X2 (slot)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | NR Slot | SRS carrie | Interruption length X2 (slots) | | | |
|  | length (ms) of victim cell | switching time (us) Note 1 | Sub carrier spacing for agressor cell (kHz) | | | |
|  |  |  | 60 | 120 | 480 | 960 |
| 0 | 1 | ≤ 200 | 2 | 2 | 2 | 2 |
| 1 | 0.5 | ≤ 200 | 2 | 2 | 2 | 2 |
| 2 | 0.25 | ≤ 200 | 3 | 3 | 2 | 2 |
| 3 | 0.125 | ≤ 200 | 4 | 4 | 3 | 3 |
| 5 | 0.03125 | ≤ 200 | 11 | 10 | 8 | 8 |
| 6 | 0.015625 | ≤ 200 | 21 | 18 | 15 | 15 |
| Note1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*. | | | | | | |

For intra-band SRS carrier switching in FR1or FR2, interruptions in Table 8.2.2.2.9-1 and in Table 8.2.2.2.9-2 based on SRS carrier switching time ≤ 200us shall apply. For inter-band SRS carrier switching in FR1, interruptions in Table 8.2.2.2.9-1 and in Table 8.2.2.2.9-2 shall apply.

##### 8.2.4.2.10 Interruptions at direct SCell activation

When one or multiple SCell(s) are directly activated at SCell addition:

- the UE is allowed an interruption on any active serving cell:

- of up to the duration shown in Table 8.2.4.2.1-1, if the active serving cell is not in the same band as the SCell being directly activated, where the requriements for Sync apply for synchronous NR-DC, and for asynchronous NR-DC if the active serving cell is in the same CG as the SCell being directly activated, and the requriements for Async apply for asynchronous NR-DC if the active serving cell is not in the same CG as the SCell being directly activated, or

- of up to the duration shown in Table 8.2.4.2.1-2, if the active serving cells are in the same band as the SCell being directly activated provided the cell specific reference signals from the active serving cells and the SCell being directly activated are available in the same slot.

##### 8.2.4.2.11 Interruptions when identifying CGI of an NR cell with autonomous gaps

When a UE is identifying CGI of an NR cell with autonomous gaps, the UE is allowed interruptions on PCell, PSCell or any activated SCell:

- with up to K1 interruptions with interrupted slots up to interruption length X1 specified in Table 8.2.4.2.11-1 for each interruption during MIB decoding time period TMIB (ms) specified in clause 9.11.

- with up to L1 interruptions with interrupted slots up to interruption length Y1 specified in Table 8.2.4.2.11-1 during SIB1 decoding time period TSIB1 (ms) specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 1.

- with up to L2 interruptions with interrupted slots up to interruption length Y2 specified in Table 8.2.4.2.11-1 during SIB1 decoding time period TSIB1 (ms) specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3.

Where:

- K1 = 6 for the target cell carrier frequency on FR1 and K1 = 25 for the target cell carrier frequency on FR2, and

- L1 = TSIB1/20, and

- L2 = TSIB1/TSMTC, where TSMTC is the periodicity of the SMTC occasion configured for the target cell carrier.

Table 8.2.4.2.11-1: Interruption length X1, Y1 and Y2 during measurements with autonomous gaps

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NR Slot length (ms) of victim cell | Interruption length X1 (slots) | Interruption length Y1 (slots) | Interruption length Y2 (slots) |
| 0 | 1 | 6 | 7 | 6 |
| 1 | 0.5 | 12 | 13 | 10 |
| 2 | 0.25 | 24 | 25 | 19 |
| 3 | 0.125 | 48 | 49 | 37 |
| 5 | 0.03125 | 192 | 193 | 145 |
| 6 | 0.015625 | 384 | 385 | 289 |

##### 8.2.4.2.12 Interruptions when identifying CGI of an E-UTRA cell with autonomous gaps

When a UE is identifying CGI of an E-UTRA FDD cell or E-UTRA TDD cell with autonomous gaps, within time period Tidentify\_CGI, E-UTRA specified in clause 9.4.7.1, the UE shall be able to transmit at least the number of ACK/NACKs specified in Table 8.2.4.2.12-1 on PCell, PSCell or any activated SCell in the frequency range where autonomous gaps are used, provided that:

- there is continuous DL data allocation,

- no DRX cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each slot,

- 2 slot ACK/NACK feedback is configured,

- 20 ms SMTC period is configured.

Table 8.2.4.2.12-1: Minimum number of ACK/NACKs transmitted by the UE during Tidentify\_CGI, E-UTRA

|  |  |  |
| --- | --- | --- |
| Minimum number of transmitted ACK/NACKs | Configuration of the serving cell in which the transmitted ACK/NACKs are counted | |
|  | Duplex mode configuration | SCS |
| 84 | FDD | 15 kHz |
| 193 | FDD | 30 kHz |
| 402 | FDD | 60 kHz |
| 28 | TDD Note 1 | 15 kHz |
| 81 | TDD Note 1 | 30 kHz |
| 159 | TDD Note 1 | 60 kHz |
| 233 | TDD Note 2 | 60 kHz |
| 491 | TDD Note 2 | 120 kHz |
| NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18].  NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19]. | | |

##### 8.2.4.2.13 Interruptions due to SCell dormancy

8.2.4.2.13.1 Interruptions due to SCell dormancy switch

When one SCell in MCG or SCG is switched from dormancy to non-dormancy or from non-dormancy to dormancy [7] when UE is in DRX active time,

- the UE is allowed an interruption on active serving cell in MCG and SCG as defined in clause 8.2.4.2.5, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP

- The starting time of interruption shall be within the dormancy switching delay as defined in clause 8.6.2.

When multiple SCells in MCG or SCG are switched from dormancy to non-dormancy or vice versa when the UE is in DRX active time, the interruption requirement described above applies for each BWP switch.

8.2.4.2.13.2 Interruptions due to CQI measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of CQI measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from CQI measurements on dormant SCells shall not exceed 0.5%.

8.2.4.2.13.3 Interruptions due to RRM measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of RRM measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from RRM measurements on dormant SCells shall not exceed 1.0%.

#### 8.2.4.2A Void

##### 8.2.4.2A.1 Void

##### 8.2.4.2A.2 Void

##### 8.2.4.2A.3 Void

<End of Change 9>

<Start of Change 10 (R4-2201198)>

8.6.1 Introduction

The requirements in this clause apply for a UE configured 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. The requirements in this clause also apply for a UE configured with more than one BWP on PCell or any activated SCell with CCA in standalone NR, or PSCell or any activated SCell with CCA in SCG in EN-DC. The requirements in 8.6.4 apply for a UE which is capable of *ul-LBT-FailureDetectionRecovery-r16* configured with more than one UL BWP on PCell with CCA in standalone NR or PSCell with CCA 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 with more than one BWP configurations configured.

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 + Y which starts from the beginning of DL slot n. Where,

- Y=0, if the serving cell where UE receives DCI for BWP switch request is same as the serving cell on which BWP switch occurs.

- Y equals to the length of 1 slot, if the serving cell where UE receives DCI for BWP switch is different from the serving cell on which BWP switch occurs for any involved serving cell. In this scenario, TBWPswitchDelay + Y shall follow the smaller SCS of scheduling cell, scheduled cells before and scheduled cells after active BWP change.If both scheduling cell and scheduled cell are in FR2-2, Y shall follow the SCS of 120 KHz.

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** | **BWP switch delay TBWPswitchDelay (slots)** | |
|  | **(ms)** | **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 |
| 5 | 0.03125 | 20 | 65 |
| 6 | 0.015625 | 39 | 129 |
| 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.

If the BWP switch is triggered within or outside DRX active time, and one of the two BWPs in a BWP switching is a dormant BWP [TS 38.321, 7], UE shall be able to complete active BWP switching within the time duration of

- TdormantBWPswitchDelay =TBWPswitchDelay+ X, provided that the dormancy indication is received in any of the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is receiveds, or

- TdormantBWPswitchDelay =TBWPswitchDelay + X + Z, provided that the dormancy indication is received after the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, where

- TBWPswitchDelay is defined in Table 8.6.2-1 corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs;

- X equals to the length of 1 slot corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs. If both scheduling cell and scheduled cell are in FR2-2, Y shall follow the SCS of 120 KHz.

- Z equals to the length of 1 slot corresponding to the SCS of the serving cell where UE receives dormancy indication.

For DCI-based BWP switch, if the new BWP is a dormant BWP, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive CSI-RS (for DL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL slot occurs right after a time duration of TdormantBWPswitchDelay which starts from the beginning of DL slot n.

8.6.2A DCI based BWP switch delay on multiple CCs

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

8.6.2A.1 Simultaneous DCI 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.

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.

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

TMultipleBWPswitchDelay = TBWPswitchDelay + D\*(N-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]. TBWPswitchDelay shall be based on the smallest SCS among SCS of all involved CCs before and after BWP switch. If the BWP switch on multiple CCs results in the change of the SCS on any CC among involved CCs, TBWPswitchDelay should be based on the smallest SCS among all SCS values of all involved CCs.

- D is the incremental delay for each additional CC involved in simultaneous BWP switch and depends on UE capability *bwp-SwitchingMultiCCs-r16* [TS 38.306, 14] for switching between non-dormant BWPs, and *bwp-SwitchingMultiDormancyCCs-r16* for switching between non-dormant and dormant BWPs.

- For UE which is capable of per-FR gap, and no BWP switch involves SCS change, N is the number of CCs in same FR; For UE which is not capable of per-FR gap, or the BWP switches on any CC involves SCS changing, N is the number of CCs undergoing simultaneous BWP switch.

* Y=0, ­if the serving cell where UE receives DCI for BWP switch is same as the serving cell on which BWP switch occurs for each involved serving cell.

Y equals to the length of one slot at smaller SCS of scheduling cell, scheduled cells before and scheduled cells after active BWP change, ­if the serving cell where UE receives DCI for BWP switch is different from the serving cell on which BWP switch occurs for any involved serving cell. If both scheduling cell and scheduled cell are in FR2-2, Y shall follow the SCS of 120 KHz.

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.

If the BWP switch is triggered on multiple CCs simultaneously within or outside DRX active time, and one of the two BWPs on each CC in a BWP switching is a dormant BWP [TS 38.321, 7], UE shall be able to complete active BWP switching within the time duration of

- TDormantMultipleBWPswitchDelay = TMultipleBWPswitchDelay+X, provided that the dormancy indication is received in any of the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, or

- TDormantMultipleBWPswitchDelay = TMultipleBWPswitchDelay +X+Z, provided that the dormancy indication is received after the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, where

- TMultipleBWPswitchDelay is defined above corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs;

- X equals to the length of 1 slot corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs. If both scheduling cell and scheduled cell are in FR2-2, Y shall follow the SCS of 120 KHz.

- Z equals to the length of 1 slot corresponding to the SCS of the serving cell where DCI for dormancy indication is received.

The number of CCs, N, on which the UE can simultaneously switch BWPs while still meeting the requirements, if any, related to allocations on downlink, uplink, or transmission of HARQ-ACK, depends on the UE reported capabilities related to BWP switching, the network configuration and the BWP switch method.

<End of Change 10>

<Start of Change 11(R4-2202663)>

### 9.1.2 Measurement gap

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE does not support independent measurement gap patterns for different frequency ranges as specified in Table 5.1-1 in [18, 19, 20], in order for the requirements in the following clauses to apply the network must provide a single per-UE measurement gap pattern for concurrent monitoring of all frequency layers.

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports independent measurement gap patterns for different frequency ranges as specified in Table 5.1-1 in [18, 19, 20], in order for the requirements in the following clauses to apply the network must provide either per-FR measurement gap patterns for frequency range where UE requires per-FR measurement gap for concurrent monitoring of all frequency layers of each frequency range independently, or a single per-UE measurement gap pattern for concurrent monitoring of all frequency layers of all frequency ranges.

If the UE is configured via LPP [34] to measure PRS for any RSTD, PRS-RSRP, and UE Rx-Tx time difference measurement defined in TS 38.215 [4], in order for the requirements in clauses 9.9.2, 9.9.3, and 9.9.4 to apply, the network must provide

- a single per-UE measurement gap pattern for concurrent monitoring of all positioning frequency layers and intra-frequency, inter-frequency and/or inter-RAT frequency layers of all frequency ranges, or

- for measurement gap patterns other than #24 and #25, if UE supports independent measurement gap patterns for different frequency ranges, per-FR measurement gap pattern for the frequency range for concurrent monitoring of all positioning frequency layers and intra-frequency, inter-frequency cells and/or inter-RAT frequency layers in the corresponding frequency range.

During the per-UE measurement gaps the UE:

- is not required to conduct reception/transmission from/to the corresponding E-UTRAN PCell, E-UTRAN SCell(s) and NR serving cells for E-UTRA-NR dual connectivity except the reception of signals used for RRM measurement(s) and the signals used for random access procedure according to TS38.321 [7].

- is not required to conduct reception/transmission from/to the corresponding NR serving cells for SA (with single carrier or CA configured) except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to [7].

- is not required to conduct reception/transmission from/to the corresponding PCell, SCell(s) and E-UTRAN serving cells for NR-E-UTRA dual connectivity except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to [7].

- is not required to conduct reception/transmission from/to the corresponding NR serving cells for NR-DC except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to [7].

During the per-FR measurement gaps the UE:

- is not required to conduct reception/transmission from/to the corresponding E-UTRAN PCell, E-UTRAN SCell(s) and NR serving cells in the corresponding frequency range for E-UTRA-NR dual connectivity except the reception of signals used for RRM measurement(s) and the signals used for random access procedure according to TS38.321 [7].

- is not required to conduct reception/transmission from/to the corresponding NR serving cells in the corresponding frequency range for SA (with single carrier or CA configured) except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to TS38.321 [7].

- is not required to conduct reception/transmission from/to the corresponding PCell, SCell(s) and E-UTRAN serving cells in the corresponding frequency range for NR-E-UTRA dual connectivity except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to TS38.321 [7].

- is not required to conduct reception/transmission from/to the corresponding NR serving cells in the corresponding frequency range for NR-DC except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to TS38.321 [7].

UEs shall support the measurement gap patterns listed in Table 9.1.2-1 based on the applicability specified in table 9.1.2-2 and 9.1.2-3. UE determines measurement gap timing based on gap offset configuration and measurement gap timing advance configuration provided by higher layer signalling as specified in TS 38.331 [2] and TS 36.331 [16].

Table 9.1.2-1: Gap Pattern Configurations

|  |  |  |
| --- | --- | --- |
| Gap Pattern Id | Measurement Gap Length (MGL, ms) | Measurement Gap Repetition Period  (MGRP, ms) |
| 0 | 6 | 40 |
| 1 | 6 | 80 |
| 2 | 3 | 40 |
| 3 | 3 | 80 |
| 4 | 6 | 20 |
| 5 | 6 | 160 |
| 6 | 4 | 20 |
| 7 | 4 | 40 |
| 8 | 4 | 80 |
| 9 | 4 | 160 |
| 10 | 3 | 20 |
| 11 | 3 | 160 |
| 12 | 5.5 | 20 |
| 13 | 5.5 | 40 |
| 14 | 5.5 | 80 |
| 15 | 5.5 | 160 |
| 16 | 3.5 | 20 |
| 17 | 3.5 | 40 |
| 18 | 3.5 | 80 |
| 19 | 3.5 | 160 |
| 20 | 1.5 | 20 |
| 21 | 1.5 | 40 |
| 22 | 1.5 | 80 |
| 23 | 1.5 | 160 |
| 24 | 10 | 80 |
| 25 | 20 | 160 |

Table 9.1.2-2: Applicability for Gap Pattern Configurations supported by the E-UTRA-NR dual connectivity UE or NR-E-UTRA dual connectivity UE

|  |  |  |  |
| --- | --- | --- | --- |
| Measurement gap pattern configuration | Serving cell | Measurement PurposeNote 5 | Applicable Gap Pattern Id |
| Per-UE | E-UTRA + FR1, or | non-NR RAT Note1,2 | 0,1,2,3 |
| Measurement gap | E-UTRA + FR2, or E-UTRA + FR1 + FR2 | FR1 and/or FR2 Note 7 | 0-11, 24, 25 |
|  |  | non-NR RATNote1,2 and FR1 and/or FR2 Note 7 | 0, 1, 2, 3, 4, 6, 7, 8,10, 24 |
|  | E-UTRA and, FR1 if configured | non-NR RAT Note1,2 | 0,1,2,3 |
|  | FR2 if configured |  | No gap |
|  | E-UTRA and, FR1 if configured | FR1 only | 0-11 |
|  | FR2 if configured |  | No gap |
|  | E-UTRA and, FR1 if configured | FR2 only | No gap |
| Per-FR | FR2 if configured |  | 12-23 |
| measurement gap | E-UTRA and, FR1 if configured | non-NR RAT Note1,2 and FR1 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
|  | FR2 if configured |  | No gap |
|  | E-UTRA and, FR1 if configured | FR1 and FR2 | 0-11 |
|  | FR2 if configured |  | 12-23 |
|  | E-UTRA and, FR1 if configured | non-NR RAT Note1,2 and FR2 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
|  | FR2 if configured |  | 12-23 |
|  | E-UTRA and, FR1 if configured | non-NR RAT Note1,2 and FR1 and FR2 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
|  | FR2 if configured |  | 12-23 |
| Note: In E-UTRA-NR dual connectivity mode, if GSM or UTRA TDD or UTRA FDD inter-RAT frequency layer is configured to be monitored, only measurement gap pattern #0 and #1 can be used for per-FR gap in E-UTRA and FR1 if configured, or for per-UE gap. In NR-E-UTRA dual connectivity mode, if UTRA FDD inter-RAT frequency layer is configured to be monitored for SRVCC, only measurement gap pattern #0 and #1 can be used for per-FR gap in E-UTRA and FR1 if configured, or for per-UE gap.  NOTE 1: In E-UTRA-NR dual connectivity mode, non-NR RAT includes E-UTRA, UTRA and/or GSM. In NR-E-UTRA dual connectivity mode, non-NR RAT means E-UTRA, and UTRA for SRVCC.  NOTE 2: Void  NOTE 3: When E-UTRA inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, only Gap Pattern #0 can be used.  NOTE 4: For UE supporting *supportedGapPattern-NRonly-NEDC* or *measGapPatterns-NRonly-ENDC-r16* but not supporting *supportedGapPattern* for the corresponding gap patterns among GP2-11, the corresponding gap patterns are not applicable to measurement of non-NR RATs as defined in NOTE 1.  NOTE 5: Inclusion of positioning measurements: Measurement purpose which includes E-UTRA measurements includes also E-UTRA RSRP and E-UTRA RSRQ measurements for E-CID.  NOTE 6: Measurement gap patterns #24 and #25 can be requested [2] only when the UE is configured at least with any of RSTD, UE Rx-Tx, or PRS-RSRP measurements requiring such gaps and can only be used during the corresponding positioning measurement period  NOTE 7: Inclusion of positioning measurements for per-UE measurement gaps: Measurement purpose which includes any of FR1 and FR2 measurements includes also RSTD, UE Rx-Tx, and PRS-RSRP measurements. | | | |

In E-UTRA-NR dual connectivity mode,

- if per-UE measurement gap is configured with MG timing advance of TMG ms, the measurement gap starts at time TMG ms advanced to the end of the latest E-UTRA subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

- if per-FR measurement gap for FR1 is configured with MG timing advance of TMG ms, the measurement gap for FR1 starts at time TMG ms advanced to the end of the latest E-UTRA subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

- if per-FR measurement gap for FR2 is configured with MG timing advance of TMG ms, the measurement gap for FR2 starts at time TMG ms advanced to the end of the latest NR subframe occurring immediately before the configured measurement gap among SCG serving cells subframes in FR2.

In NR-E-UTRA dual connectivity mode,

- if per-UE measurement gap is configured with MG timing advance of TMG ms, the measurement gap starts at time TMG ms advanced to the end of the latest NR subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

- if per-FR measurement gap for FR1 is configured with MG timing advance of TMG ms and UE has NR serving cell in FR1, the measurement gap for FR1 starts at time TMG ms advanced to the end of the latest NR subframe occurring immediately before the configured measurement gap among MCG serving cells subframes in FR1.

- if per-FR measurement gap for FR1 is configured with MG timing advance of TMG ms and UE doesn’t have NR serving cell in FR1, the measurement gap for FR1 starts at time TMG ms advanced to the end of the latest E-UTRA subframe occurring immediately before the configured measurement gap among SCG serving cells subframes.

- if per-FR measurement gap for FR2 is configured with MG timing advance of TMG ms, the measurement gap for FR2 starts at time TMG ms advanced to the end of the latest NR subframe occurring immediately before the configured measurement gap among MCG serving cells subframes in FR2.

In NR-NR dual connectivity mode,

- If per-UE measurement gap is configured with MG timing advance of TMG ms, the measurement gap starts at time TMG ms advanced to the end of the latest MCG subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

- If per-FR measurement gap for FR1 is configured with MG timing advance of TMG ms, the measurement gap for FR1 starts at time TMG ms advanced to the end of the latest MCG subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

- If per-FR measurement gap for FR2 is configured with MG timing advance of TMG ms, the measurement gap for FR2 starts at time TMG ms advanced to the end of the latest SCG subframe occurring immediately before the configured measurement gap among SCG serving cells subframes in FR2.

TMG is the MG timing advance value provided in *mgta* according to TS38.331 [2].

In determining the measurement gap starting point, UE shall use the DL timing of the latest E-UTRA or NR subframe occurring immediately before the configured measurement gap among E-UTRA or NR serving cells.

For per-FR measurement gap capable UE configured with E-UTRA-NR dual connectivity or NR-E-UTRA dual connectivity, when serving cells are in E-UTRA and FR1, measurement objects are in both E-UTRA/FR1 and FR2,

- If MN indicates UE that the measurement gap from MN applies to E-UTRA/FR1/FR2 serving cells, UE fulfils the per-UE measurement requirements for both E-UTRA/FR1 and FR2 measurement objects based on the measurement gap pattern configured by MN;

- If MN indicates UE that the measurement gap from MN applies to only LTE/FR1 serving cell(s),

- UE fulfils the measurement requirements for FR1/LTE measurement objects based on the configured measurement gap pattern;

- UE fulfils the requirements for FR2 measurement objects based on effective MGRP=20ms;

For per-FR measurement gap capable configured with E-UTRA-NR dual connectivity, NR-E-UTRA dual connectivity or NR-NR dual connectivity, when serving cells are in E-UTRA, FR1 and FR2, or in E-UTRA and FR2, or in FR1 and FR2, measurement objects are in both E-UTRA /FR1 and FR2,

- If MN indicates UE that the measurement gap from MN applies to E-UTRA/FR1/FR2 serving cells, UE fulfils the per-UE measurement requirements for both E-UTRA/FR1 and FR2 measurement objects based on the measurement gap pattern configured by MN.

Table 9.1.2-3: Applicability for Gap Pattern Configurations supported by the UE with NR standalone operation (with single carrier, NR CA and NR-DC configuration)

|  |  |  |  |
| --- | --- | --- | --- |
| Measurement gap pattern configuration | Serving cell | Measurement Purpose NOTE 2 | Applicable Gap Pattern Id |
|  | FR1 NOTE5, or  FR1 + FR2 | non-NR RAT NOTE3,6 | 0,1,2,3 |
|  |  | FR1 and/or FR2 NOTE 9 | 0-11, 24, 25 |
|  |  | non-NR RATand FR1 and/or FR2 NOTE3,6,9 | 0, 1, 2, 3, 4, 6, 7, 8,10, 24 |
| Per-UE measurement | FR2 NOTE5 | non-NR RATonly  NOTE3,6 | 0,1,2,3 |
| gap |  | FR1 only NOTE 9 | 0-11, 24, 25 |
|  |  | FR1 and FR2 NOTE 9 | 0-11, 24, 25 |
|  |  | non-NR RATand FR1 and/or FR2 NOTE3,6,9 | 0, 1, 2, 3, 4, 6, 7, 8,10, 24 |
|  |  | FR2 only NOTE 9 | 12-23 |
|  | FR1 if configured | non-NR RATonly | 0,1,2,3 |
|  | FR2 if configured | NOTE3,6 | No gap |
|  | FR1 if configured | FR1 only | 0-11 |
|  | FR2 if configured |  | No gap |
|  | FR1 if configured | FR2 only | No gap |
| Per-FR | FR2 if configured |  | 12-23 |
| measurement | FR1 if configured | non-NR RATand | 0, 1, 2, 3, 4, 6, 7, 8,10 |
| gap | FR2 if configured | FR1 NOTE3,6 | No gap |
|  | FR1 if configured | FR1 and FR2 | 0-11 |
|  | FR2 if configured |  | 12-23 |
|  | FR1 if configured | non-NR RATand | 0, 1, 2, 3, 4, 6, 7, 8,10 |
|  | FR2 if configured | FR2 NOTE3,6 | 12-23 |
|  | FR1 if configured | non-NR RATand | 0, 1, 2, 3, 4, 6, 7, 8,10 |
|  | FR2 if configured | FR1 and FR2 NOTE3,6 | 12-23 |
| NOTE 1: When E-UTRA inter-RAT RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, only Gap Pattern #0 can be used.  NOTE 2: Measurement purpose which includes E-UTRA measurements includes also inter-RAT E-UTRA RSRP and RSRQ measurements for E-CID; measurement purpose which includes E-UTRA measurements includes also E-UTRA RSRP and E-UTRA RSRQ measurements for E-CID.  NOTE 3: Void  NOTE4: If per-UE measurement gap is configured with MG timing advance of TMG ms, the measurement gap starts at time TMG ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among all serving cells subframes.  If per-FR measurement gap for FR1 is configured with MG timing advance of TMG ms, the measurement gap for FR1 starts at time TMG ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among serving cells subframes in FR1.  If per-FR measurement gap for FR2 is configured with MG timing advance of TMG ms, the measurement gap for FR2 starts at time TMG ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among serving cells subframes in FR2.  TMG is the MG timing advance value provided in *mgta* according to [2].  In determining the measurement gap starting point, UE shall use the DL timing of the latest subframe occurring immediately before the configured measurement gap among serving cells.  NOTE 5: NR-DC in Rel-15 only includes the scenarios where all serving cells in MCG in FR1 and all serving cells in SCG in FR2.  NOTE 6: In NR single carrier, NR CA, and NR-DC mode, non-NR RAT means E-UTRA, and UTRA for SRVCC. In NR single carrier, NR CA, and NR-DC mode, if UTRA FDD inter-RAT frequency layer is configured to be monitored for SRVCC, only measurement gap pattern #0 and #1 can be used for per-FR gap in E-UTRA and FR1 if configured, or for per-UE gap.  NOTE 7: For UE only supporting *supportedGapPattern-NRonly* for any gap patterns among GP2-11, the corresponding gap patterns are not applicable to measurement of non-NR RATs as defined in NOTE 6.  NOTE 8: Measurement gap patterns #24 and #25 can be requested [2] only when the UE is configured with any of RSTD, UE Rx-Tx, or PRS-RSRP measurements requiring such gaps and can only be used during the corresponding positioning measurement period.  NOTE 9: Inclusion of positioning measurements for per-UE measurement gaps: Measurement purpose which includes any of FR1 and FR2 measurements includes also RSTD, UE Rx-Tx, and PRS-RSRP measurements. | | | |

For per-FR measurement gap capable UE in NR standalone operation (with single carrier, NR CA and NR-DC configuration), for per-FR gap based measurement, when there is no serving cell in a particular FR, where measurement objects are configured, regardless if explicit per-FR measurement gap is configured in this FR, the effective MGRP in this FR is used to determine requirements;

- 20 ms for FR2 NR measurements

- 40 ms for FR1 NR measurements

- 40 ms for LTE measurements

- 40 ms for FR1+LTE measurements

For per-FR measurement gap capable UE in NR standalone operation (with single carrier, NR CA and NR-DC configuration), when serving cells are in FR1 or FR2, measurement objects are in both E-UTRA /FR1 and FR2,

- If MN indicates UE that the measurement gap from MN applies to E-UTRA/FR1/FR2 serving cells, UE fulfils the per-UE measurement requirements for both E-UTRA/FR1 and FR2 measurement objects based on the measurement gap pattern configured by MN;

If measurement gap is configured in one FR but measurement object is not configured in the FR, the scheduling opportunity in the FR depends on the configured measurement gap pattern.

For CA with aligned frame boundaries,

For E-UTRA-NR dual connectivity, if UE is not capable of per-FR-gap, total interruption time on SCG during MGL is defined only when MGL(N) = 20ms, 10ms, 6ms, 4ms and 3ms. And if UE is capable of per-FR-gap, total interruption time on FR1 serving cells in SCG during MGL is defined only when MGL(N) = 20ms, 10ms, 6ms, 4ms and 3ms, and total interruption time on FR2 serving cells in SCG during MGL is defined only when MGL(N) = 20ms, 10ms, 5.5ms, 3.5ms and 1.5ms.

For NR standalone operation (with single carrier, NR CA and NR-DC configuration), if UE is not capable of per-FR-gap, total interruption time on a serving cell during MGL is defined when MGL(N) = 20ms, 10ms, 6ms, 5.5ms, 4ms, 3.5ms, 3ms, and 1.5ms. And if UE is capable of per-FR-gap, total interruption time on FR1 serving cells during MGL is defined only when MGL(N) = 20ms, 10ms, 6ms, 4ms, and 3ms, and total interruption time on FR2 serving cells during MGL is defined only when MGL(N) = 20ms, 10ms, 5.5ms, 3.5ms, and 1.5ms.

For NR-E-UTRA dual connectivity, if UE is not capable of per-FR-gap, total interruption time on MCG during MGL is defined only when MGL(N) = 20ms, 10ms, 6ms, 4ms, and 3ms. And if UE is capable of per-FR-gap, total interruption time on FR1 serving cells in MCG during MGL is defined only when MGL(N) = 20ms, 10ms, 6ms, 4ms, and 3ms, and total interruption time on FR2 serving cells in MCG during MGL is defined only when MGL(N) = 20ms, 10ms, 5.5ms, 3.5ms, and 1.5ms.

For CA with non-aligned frame boundaries,

- The total interruption time on an SCC is the same as the case CA with aligned frame boundaries, if no SCC slots are partially overlapped with the measurement gap.

- The total interruption time on an SCC will be additionally extended by one SCC slot, if there exist SCC slots partially overlapped with the measurement gap.



(a) Measurement gap with MGL = N(ms) with MG timing advance of 0ms for all serving cells in synchronous EN-DC, NR standalone operation (with single carrier, NR CA and synchronous NR-DC configuration) and synchronous NE-DC, and for serving cells in MCG in NR standalone operation (with asynchronous NR-DC configuration)



(b) Measurement gap with MGL = N(ms) with MG timing advance of 0.5ms for all serving cells in synchronous EN-DC, NR standalone operation (with single carrier, NR CA and synchronous NR-DC configuration) and synchronous NE-DC, and for serving cells in MCG in NR standalone operation (with asynchronous NR-DC configuration)



(c) Measurement gap with MGL = N(ms) with MG timing advance of 0ms for all serving cells in asynchronous EN-DC and asynchronous NE-DC, and for serving cells in SCG in NR standalone operation (with asynchronous NR-DC configuration)



(d) Measurement gap with MGL = N(ms) with MG timing advance of 0.5ms for all serving cells in asynchronous EN-DC and asynchronous NE-DC, and for serving cells in SCG in NR standalone operation (with asynchronous NR-DC configuration)

Figure 9.1.2-1: Measurement GAP and total interruption time on serving cells for EN-DC, NR standalone operation (with single carrier, NR CA and NR-DC configuration) and NE-DC

The corresponding total number of interrupted slots on serving cells is listed in Table 9.1.2-4 for all serving cells in synchronous EN-DC, NR standalone (with single carrier, NR CA and synchronous NR-DC configuration) and NE-DC, and for serving cells in MCG in NR standalone operation (with asynchronous NR-DC configuration). The corresponding total number of interrupted slots on serving cells is listed in Table 9.1.2-4a for asynchronous EN-DC, and for serving cells in SCG in NR standalone operation (with asynchronous NR-DC configuration).

Table 9.1.2-4: Total number of interrupted slots on all serving cells during MGL for Synchronous EN-DC, NR standalone operation (with single carrier, NR CA and synchronous NR-DC configuration) and NE-DC, and on all serving cells in MCG for NR standalone operation (with asynchronous NR-DC configuration) with per-UE measurement gap or per-FR measurement gap for FR1

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR | Total number of interrupted slots on serving cells | | | | | | | | | |
| SCS | When MG timing advance of 0ms is applied | | | | | When MG timing advance of 0.5ms is applied | | | | |
| (kHz) | MGL=20ms | MGL=10ms | MGL=6ms | MGL=4ms | MGL=3ms | MGL=20ms | MGL=10ms | MGL=6ms | MGL=4ms | MGL=3ms |
| 15 | 20 | 10 | 6 | 4 | 3 | 21Note3 | 11Note3 | 7Note3 | 5Note3 | 4Note3 |
| 30 | 40 | 20 | 12 | 8 | 6 | 40 | 20 | 12 | 8 | 6 |
| 60 | 80 | 40 | 24 | 16 | 12 | 80 | 40 | 24 | 16 | 12 |
| 120 | 160 | 80 | 48 | 32 | 24 | 160 | 80 | 48 | 32 | 24 |
| 480 Note4 | 640 | 320 | 192 | 128 | 96 | 640 | 320 | 192 | 128 | 96 |
| 480 Note5 | 641 | 321 | 193 | 129 | 97 | 641 | 321 | 193 | 129 | 97 |
| 960 Note4 | 1280 | 640 | 384 | 256 | 192 | 1280 | 640 | 384 | 256 | 192 |
| 960 Note5 | 1281 | 641 | 385 | 257 | 193 | 1281 | 641 | 385 | 257 | 193 |
| NOTE 1: For Gap Pattern ID 0, 1, 2 and 3, total number of interrupted subframes on MCG is MGL subframes when MG timing advance of 0ms is applied, and (MGL+1) subframes when MG timing advance of 0.5ms is applied.  NOTE 2: NR SCSs of 120 kHz, 480kHz and 960kHz are only applicable to the case with per-UE measurement gap.  NOTE 3: Non-overlapped half-slots occur before and after the measurement gap. Whether a Rel-15 UE can receive and/or transmit in those half-slots is up to UE implementation.  NOTE 4: For NR SCSs of 480kHz and 960kHz, total number of interrupted slots on all serving cells during MGL for single carrier, intra-band NR CA with per-UE measurement gap.  NOTE 5: For NR SCSs of 480kHz and 960kHz, total number of interrupted slots on all serving cells in SCG for inter-band NR-CA and synchronous NR-DC with per-UE measurement gap. | | | | | | | | | | |

Table 9.1.2-4a: Total number of interrupted slots on serving cells during MGL for Asynchronous EN-DC, and on all serving cells in SCG for NR standalone operation (with asynchronous NR-DC configuration) with per-UE measurement gap or per-FR measurement gap for FR1

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR | Total number of interrupted slots on serving cells | | | | | | | | | |
| SCS | When MG timing advance of 0ms is applied | | | | | When MG timing advance of 0.5ms is applied | | | | |
| (kHz) | MGL=20ms | MGL=10ms | MGL=6ms | MGL=4ms | MGL=3ms | MGL=20ms | MGL=10ms | MGL=6ms | MGL=4ms | MGL=3ms |
| 15 | 21 | 11 | 7 | 5 | 4 | 21 | 11 | 7 | 5 | 4 |
| 30 | 41 | 21 | 13 | 9 | 7 | 41 | 21 | 13 | 9 | 7 |
| 60 | 81 | 41 | 25 | 17 | 13 | 81 | 41 | 25 | 17 | 13 |
| 120 | 161 | 81 | 49 | 33 | 25 | 161 | 81 | 49 | 33 | 25 |
| 480 Note3 | 641 | 321 | 193 | 129 | 97 | 641 | 321 | 193 | 129 | 97 |
| 960 Note3 | 1281 | 641 | 385 | 257 | 193 | 1281 | 641 | 385 | 257 | 193 |
| NOTE 1: For Gap Pattern ID 0, 1, 2 and 3, total number of interrupted subframes on MCG is MGL subframes when MG timing advance of 0ms is applied, and (MGL+1) subframes when MG timing advance of 0.5ms is applied.  NOTE 2: NR SCSs of 120 kHz, 480kHz and 960kHz are only applicable to the case with per-UE measurement gap.  NOTE 3: For NR SCSs of 480kHz and 960kHz, total number of interrupted slots on all serving cells in SCG for asynchronous NR-DC with per-UE measurement gap. | | | | | | | | | | |

In case that UE capable of per-FR measurement gap is configured with per-FR measurement gap for FR2 serving cells, total number of interrupted slots on FR2 serving cells during MGL is listed in Table9.1.2-4b.

**Table 9.1.2-4b: Total number of interrupted slots on FR2 serving cells during MGL for EN-DC, NR standalone operation (with single carrier, NR CA and NR-DC configuration) and NE-DC with per-UE measurement gap or per-FR measurement gap for FR2**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR | Total number of interrupted slots on FR2 serving cells | | | | | | | | | |
| SCS | When MG timing advance of 0ms is applied | | | | | When MG timing advance of 0.25ms is applied | | | | |
| (kHz) | MGL=  20ms | MGL=  10ms | MGL=  5.5ms | MGL=  3.5ms | MGL=  1.5ms | MGL=  20ms | MGL=  10ms | MGL=  5.5ms | MGL=  3.5ms | MGL=  1.5ms |
| 60 | 80 | 40 | 22 | 14 | 6 | 80 | 40 | 22 | 14 | 6 |
| 120 | 160 | 80 | 44 | 28 | 12 | 160 | 80 | 44 | 28 | 12 |
| 480 Note3 | 640 | 320 | 176 | 112 | 48 | 640 | 320 | 176 | 112 | 48 |
| 960 Note3 | 1280 | 640 | 352 | 224 | 96 | 1280 | 640 | 352 | 224 | 96 |
| NOTE 1: The total number of interrupted slots is based on that SFN and subframe reference for per-FR gap in FR2 indicated by high layer parameter *refServCellIndicator* is an FR2 serving cell.  NOTE 2: Slot occurs before or after the measurement gap may be interrupted additionally if SFN and subframe reference for per-FR gap in FR2 indicated by high layer parameter refServCellIndicator is an FR1 serving cell.  NOTE 3: For NR SCSs of 480kHz and 960kHz, Total number of interrupted slots on FR2-2 serving cells during MGL for NR standalone operation (single carrier, NR CA and NR-DC) with per-UE measurement gap or per-FR measurement gap for FR2-2. | | | | | | | | | | | |

It is up to UE implementation whether or not the UE is able to conduct transmission in the following slot(s),

- when MGTA is not applied, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after measurement gap

- when MGTA is applied and the SCS of the UL carrier is other than 15kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after measurement gap

- when MGTA is applied and the SCS of the UL carrier is 15kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the slot partially overlapped with measurement gap

where UL slot denotes that all the symbols in the slot are uplink symbols, and L=1 if  for the UL transmission is less than the length of one slot; L=2 otherwise.

Note: Network is supposed to take into account the possible difference between the estimated TA at network and actual TA at UE when scheduling UE in the above slot(s).

Table 9.1.2-5: (Void)

<End of Change 11>

<Start of Change 12 (R4-2202757)>

##### 9.2.5.3.3 Scheduling availability of UE performing measurements on FR2

The following scheduling restriction applies due to SS-RSRP or SS-SINR measurement on an FR2 intra-frequency cell

- If *deriveSSB\_IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on K data symbol(s) before each consecutive SSB symbols to be measured and K data symbol(s) after each consecutive SSB symbols to be measured within SMTC window duration.

- If *deriveSSB\_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

The following scheduling restriction applies to SS-RSRQ measurement on an FR2 intra-frequency cell

- If *deriveSSB\_IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on K data symbol(s) before each consecutive SSB to be measured/RSSI symbols and K data symbol(s) after each consecutive SSB to be measured/RSSI symbols within SMTC window duration

*-*  If *deriveSSB\_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

where

- If the high layer signalling of *smtc2*is configured in TS 38.331 [2], the SMTC periodicityfollows *smtc2*; Otherwise the SMTC periodicity follows *smtc1.*

- The signaling *deriveSSB\_IndexFromCell* is always enabled for FR2-1 and FR2-2 when [SSB] is using 120 kHz SCS and 480 kHz SCS.

- K=1 for a serving cell with data symbols of 120 kHz SCS

- K=TBD for a serving cell with data symbols of 480 kHz SCS

- K=TBD for a serving cell with data symbols of 960 kHz SCS

<End of Change 12>