**3GPP TSG-RAN4 Meeting #115 *R4-2508454***

**Malta, MT, 19th – 23rd May, 2025**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** | **Draft** | **rev** | **-** | **Current version:** | **19.0.0** |  |
|  | | | | | | | | |
| *For* ***[HE](http://www.3gpp.org/3G_Specs/CRs.htm" \l "_blank)******[LP](http://www.3gpp.org/3G_Specs/CRs.htm" \l "_blank)*** *on using this form: comprehensive instructions can be found at  <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:*** | Big draftCR on TS 38.133 for NR ATG enhancement | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | CMCC | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_ATG\_enh-Core | | | | |  | ***Date:*** | | | 2025-05-26 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***Release:*** | | | Rel-19 |
|  | *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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19) Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Due to R19 ATG support CA feature, the related requirement shall be introduced.  The big draftCR contains the following draftCR:   |  |  |  | | --- | --- | --- | | R4-2506095 | Draft CR to TS 38.133 on general measurement requirement for R19 ATG | 9.1D | | R4-2506240 | Draft CR on L1-RSRP measurements for Reporting for ATG CA in Clause 9.5D | 9.5D | | R4-2506412 | draftCR on requirement applicability and cell re-selection requirement introduction for ATG CA | 3.6.16  4.2D  B.3.2 | | R4-2506823 | draftCR for MRTD and interruption requirements for ATG UE in R19 | 7.6D(new)  8.2D(new) | | R4-2508322 | draft CR on ATG UE Scell activation/deactivation requirement and active BWP switching delay | 8.3D(new)  8.6D | | R4-2508323 | CR on core requirements for Rel-19 ATG | 8.1D.2.2, 8.1D.3.2, 8.1D.7.2, 8.5D.2.2, 8.5D.3.2, 8.5D.5.2, 8.5D.6.2, 8.5D.7.2, 8.5D.8.2, 8.5D.10 | | R4-2508324 | Draft CR on intra-frequency measurement for R19 ATG | 9.2D.1, 9.2D.3.1, 9.2D.5.1, 9.2D.5.2, 9.2D.5.3.1, 9.2D.5.3.2 | | R4-2508325 | Draft CR for ATG Rel-19 Pre-configured measurement gap activation/deactivation delay | 8.19D | | R4-2508326 | Draft CR for L1-SINR measurements for Reporting with ATG | 9.8D | | R4-2508438 | Draft CR to TS 38.133 on CSI-RS based L3 measurements for R19 ATG | 9.10D | | R4-2508439 | Draft CR on inter-frequency measurement for R19 ATG | 9.3D.9.1, 9.3D.9.2, 9.3D.9.3.1, 9.3D.9.3.2 | | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduce RRM requirement for NR ATG enhancement | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The R19 ATG spec will not be completed | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.6.16, 4.2D, 7.6D(new), 8.1D.2.2, 8.1D.3.2, 8.1D.7.2, 8.2D(new), 8.3D(new), 8.5D.2.2, 8.5D.3.2, 8.5D.5.2, 8.5D.6.2, 8.5D.7.2, 8.5D.8.2, 8.5D.10, 8.6D, 8.19D, 9.1D, 9.2D, 9.3D.9, 9.5D, 9.8D, 9.10D, B.3.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.533 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

**<Start of change#1>**

### 3.6.16 Applicability of requirements for ATG

The requirements in ATG specific clauses apply to an ATG UE operating in FR1 NR SA including co-located intra-band DL CA and co-located inter-band DL CA operation mode at an altitude of at-least 3km.

**<End of change#1>**

**<Start of change#2>**

## 4.2D Cell Re-selection for ATG

### 4.2D.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in either *Camped* *Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency and inter-frequency cells indicated by the serving cell. For intra-frequency and inter-frequency cells, the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity.

In the requirements of clause 4.2D, the exceptions for side conditions apply as follows:

- for the UE capable of CA, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.1, for UE supporting CA in FR1.

**<End of change#2>**

**<Start of change#3>**

7.6D Maximum Receive Timing Difference for ATG UE

7.6D.1 Introduction

An ATG UE shall be capable of handling a relative receive timing difference between the closest slot timing boundaries of different carriers in FR1 to be aggregated in NR carrier aggregation.

7.6D.2 Minimum requirements for NR Carrier Aggregation

The ATG UE shall be capable of handling at least a relative receive timing difference between slot timing of all pairs of carriers in FR1 to be aggregated at the ATG UE receiver as shown in table 7.6D.2-1 below.

**Table 7.6D.2-1: Maximum receive timing difference requirement for ATG UE in inter-band NR carrier aggregation**

|  |  |
| --- | --- |
| **Frequency Range of the pair of carriers** | **Maximum receive timing difference (µs)** |
| FR1 | 33 |

**<End of change#3>**

**<Start of change#4>**

#### 8.1D.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_out\_SSB period becomes worse than the threshold Qout\_SSB within TEvaluate\_out\_SSB evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_in\_SSB period becomes better than the threshold Qin\_SSB within TEvaluate\_in\_SSB evaluation period.

TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in table 8.1D.2.2-1 for FR1.

For FR1 ATG UE with one or multiple omni-directional antenna(s),

- , when in the monitored cell there are measurement gaps configured for intra-frequency or inter-frequency measurements, and these measurement gaps are overlapping with some but not all occasions of the SSB; and

- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR1 ATG UE with the antenna array,

- P value for an RLM-RS resource to be measured is defined as

- Psharing factor \* Ntotal / Noutside\_MG with Navailable = 0

- Ntotal / Navailable with Navailable > 0

- For a window W of duration max(TL1, MGRPmax), where MGRPmax is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:

- Ntotal is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- Navailable is

- the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion of same serving cell within the window W if inter-band carrier aggregation within FR1 is configured [and UE doesn’t support capability of case 4],

- otherwise, the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W

- TL1 is periodicity of the target RLM-RS.

- Psharing factor = 3.

**<End of change#4>**

**<Start of change#5>**

#### 8.1D.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_out\_CSI-RS period becomes worse than the threshold Qout\_CSI-RS within TEvaluate\_out\_CSI-RS evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_in\_CSI-RS period becomes better than the threshold Qin\_CSI-RS within TEvaluate\_in\_CSI-RS evaluation period.

- TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS are defined in table 8.1D.3.2-1 for FR1.

The requirements of TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS apply provided that the CSI-RS for RLM is not in a resource set configured with repetition ON. The requirements do not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for RLM and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR1 ATG UE with one or multiple omni-directional antenna(s),

- , when in the monitored cell there are measurement gaps configured for intra-frequency or inter-frequency measurements, and these measurement gaps are overlapping with some but not all occasions of the CSI-RS; and

- P = 1, when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR1 ATG UE with the antenna array,

- P value for an RLM-RS resource to be measured is defined as

Psharing factor \* Ntotal / Noutside\_MG with Navailable = 0

Ntotal / Navailable with Navailable > 0

- For a window W of duration max(TL1, MGRPmax), where MGRPmax is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:

- Ntotal is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- Navailable is

- the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion of same serving cell within the window W if inter-band carrier aggregation within FR1 is configured [and UE doesn’t support capability of case 4],

- otherwise, the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W.

- TL1 is periodicity of the target RLM-RS

- Psharing factor = 3.

**<End of change#5>**

**<Start of change#6>**

#### 8.1D.7.2 Scheduling availability of UE performing radio link monitoring with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to radio link monitoring based on SSB as RLM-RS.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for radio link monitoring.

When intra-band carrier aggregation in FR1 is performed, the scheduling restrictions on FR1 serving PCell applies to all serving cells in the same band on the symbols that fully or partially overlap with the restricted symbols.

When inter-band carrier aggregation within FR1 is performed, there are no scheduling restrictions on FR1 serving cell(s) in the bands due to radio link monitoring performed on FR1 serving PCell in different bands.

**<End of change#6>**

**<Start of change#7>**

8.2D Interruption for ATG UE

8.2D.1 Interruptions with Standalone NR Carrier Aggregation

8.2D.1.1 Introduction

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

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

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

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

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

- NR SRS antenna port switching on PCell, or

- SCell is activated based on aperiodic CSI-RS.

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 TS 38.331 [2] for SCell addition/release or MAC control signalling according to TS 37.340 [17] for SCell activation/deactivation command.

8.2D.1.2 Requirements

8.2D.1.2.1 Interruptions at SCell addition/release

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

- of up to the interruption length specified in table 8.2D.1.2.1-1, if the active serving cells are contiguous to any of the SCells being added or released in the same FR1 band, provided the cell specific reference signals from the active serving cells and the SCells being added or released are available in the same slot or,

- of up to the interruption length sepcified in table 8.2D.1.2.1-2, if the active serving cell and the SCell being added or released are in a FR1 band pair.

**Table 8.2D.1.2.1-1: Interruption length for SCell addition/release for ATG intra-band contiguous CA**

|  |  |  |
| --- | --- | --- |
|  | **NR Slot length (ms)** | **Interruption length (slots)** |
| 0 | 1 | 1 + TSMTC\_duration\_ATG \* |
| 1 | 0.5 | 2 + TSMTC\_duration\_ATG \* |
| NOTE 1: TSMTC\_duration\_ATG measured in subframes is  - the longest SMTC duration among all above active serving cells and the SCell being added when one SCell is added. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being added, the SSB transmission periodicity is assumed to be 5ms and TSMTC\_duration\_ATG for the SCell being added is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being added. If neither SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being added, TSMTC\_duration\_ATG for the SCell being added is 0ms;  - 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]. | | |

**Table 8.2D.1.2.1-2: Interruption length for SCell addition/release for ATG inter-band CA**

|  |  |  |
| --- | --- | --- |
|  | **NR Slot length (ms) of victim cell** | **Interruption length (slots)** |
| 0 | 1 | 1 |
| 1 | 0.5 | 2 |

8.2D.1.2.2 Interruptions at SCell activation/deactivation

When an SCell is activated or deactivated as defined in TS 37.340 [17], the ATG UE is allowed an interruption on any active serving cell:

- of up to the interruption length specified in table 8.2D.1.2.2-1, if the active serving cells are contiguous to any of the SCells being activated or deactivated in the same FR1 band, provided the cell specific reference signals from the active serving cells and the SCells being activated or deactivated are available in the same slot or,

- of up to the interruption length specified in table 8.2D.1.2.2-2, if the active serving cell and the SCell being activated or deactivated are in a FR1 band pair.

**Table 8.2D.1.2.2-1: Interruption length for SCell activation/deactivation for ATG intra-band contiguous CA**

|  |  |  |
| --- | --- | --- |
|  | **NR Slot length (ms)** | **Interruption length (slots)** |
| 0 | 1 | 1 + TSMTC\_duration\_ATG \* |
| 1 | 0.5 | 1 + TSMTC\_duration\_ATG \* |
| NOTE 1: TSMTC\_duration\_ATG measured in subframes is  - the longest SMTC duration among all above active serving cells and the SCell being activated when one SCell is activated. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being activated, the SSB transmission periodicity is assumed to be 5ms and TSMTC\_duration\_ATG for the SCell being activated is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being activated. If neither SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being activated, TSMTC\_duration\_ATG for the SCell being activated is 0ms;  - 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]. | | |

**Table 8.2D.1.2.2-2: Interruption length for SCell activation/deactivation for ATG inter-band CA**

|  |  |  |
| --- | --- | --- |
|  | **NR Slot length (ms) of victim cell** | **Interruption length X2 (slots)** |
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |

8.2D.1.2.3 Interruptions during measurements on deactivated SCC

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

- If the PCell is not in the same band as the deactivated SCell, the ATG UE is only allowed to cause interruptions on PCell immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in table 8.2D.1.2.2-1 or,

- If the PCell or activated SCell(s) is contiguous to the deactivated SCell in the same FR1 band, the ATG UE is allowed to cause an interruption on PCell no earlier than X slots before TSMTC\_duration\_ATG and no later than X slots after TSMTC\_duration\_ATG, 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\_ATG are given by table 8.2D.1.2.3-1. The interruption shall not exceed requirements in table 8.2D.1.2.3-1.

**Table 8.2D.1.2.3-1: 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\_ATG \* |
| 1 | 0.5 | 1 | 2 + TSMTC\_duration\_ATG \* |
| NOTE 1: TSMTC\_duration\_ATG 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]. | | | | |

8.2D.1.2.4 Interruptions at direct SCell activation

When one or multiple SCell(s) are directly activated at SCell addition, the ATG UE is allowed an interruption on any active serving cell:

- of up to the interruption length specified in table 8.2D.1.2.1-1, 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 or,

- of up to the interruption length specified in table 8.2D.1.2.1-2, if the active serving cell is not in the same band as the SCell being directly activated.

8.2D.1.2.5 Interruptions due to SCell dormancy

8.2D.1.2.5.1 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 ATG UE is in DRX active time,

- the ATG UE is allowed an interruption on active serving cell in MCG as defined in clause 8.2D.1.2.7, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP and,

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

8.2D.1.2.5.2 Interruptions due to CQI measurements during SCell dormancy

The requirements specified in clause 8.2.2.2.12.2 apply to ATG UE.

8.2D.1.2.5.3 Interruptions due to RRM measurements during SCell dormancy

The requirements specified in clause 8.2.2.2.13.2 apply to ATG UE.

8.2D.1.2.6 Interruptions at fast SCell activation

The requirements in this clause shall apply for the ATG UE configured with PCell and one SCell when aperiodic CSI-RS resources is configured for fast SCell activation.

When one SCell in MCG configured with aperiodic CSI-RS resources is configured for fast SCell activation is activated from deactivated, the ATG UE is allowed an interruption on any active serving cell:

- of up to the interruption length specified in table 8.2D.1.2.2-2, if the active serving cell and the SCell being activated are in a FR1 band pair.

or

- of up to A slots +TATRS\_duration\_ATG, if the active serving cells are in the same band as any of the SCells being activated, when

- SCell to be activated is known and belongs to FR1, if the measurement period of the SCell being activated is larger than 2400ms, or

- SCell is unknown and belongs to FR1, and SCell is contiguous to an active serving cell in the same band.

or

- of up to A slots if the active serving cells are in the same band as any of the SCells being activated, when SCell to be activated is known and belongs to FR1, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.

Where:

- TATRS\_duration\_ATG is CSI-RS burst for SCell activation where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots on the being activated SCell.

- A is specified in table 8.2D.1.2.6-1.

**Table 8.2D.1.2.6-1: Interruption length A at SCell activation/deactivation for ATG UE**

|  |  |  |
| --- | --- | --- |
|  | **NR Slot length (ms) of victim cell** | **Interruption length A (slots)** |
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |

8.2D.1.2.7 Interruptions due to Active BWP switching Requirement

The requirements for DCI-based BWP switch, timer-based BWP switch 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 ATG UE receives a DCI indicating UE to switch its active BWP involving changes in any of the parameters listed in table 8.2D.1.2.7-2, the ATG UE is allowed to cause interruption of up to X slots to other active serving cells if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in table 8.2D.1.2.7-2 the ATG UE is allowed to cause interruption of up to X slots to other active serving cells in the same frequency range wherein the ATG UE is performing BWP switching. X is defined in table 8.2D.1.2.7-1. The starting time of interruption is only allowed within the BWP switching delay TBWPswitchDelay as defined in clause 8.6D.2 when BWP switch occurs on a single CC. 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, the ATG UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in table 8.2D.1.2.7-2 if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in table 8.2D.1.2.7-2, the ATG UE is allowed to cause interruption of up to X slots to other active serving cells in the same frequency range wherein the ATG UE is performing BWP switching. X is defined in table 8.2D.1.2.7-1. The starting time of interruption is only allowed within the BWP switching delay TBWPswitchDelay as defined in clause 8.6D.2 when BWP switch occurs on a single CC. Interruptions are not allowed during BWP switch involving any other parameter change.

When ATG UE receives an RRC reconfiguration that only requests UE to switch its active BWP on one single CC, the ATG UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in table 8.2D.1.2.7-2 if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in table 8.2D.1.2.7-2, the ATG UE is allowed to cause interruption of up to X slots to other active serving cells in the same frequency range wherein the ATG UE is performing BWP switching. X is defined in table 8.2D.1.2.7-1. The interruption is only allowed within the delay TRRCprocessingDelay + TBWPswitchDelayRRC defined in clause 8.6D.3 when BWP switch occurs on a single CC.

**Table 8.2D.1.2.7-1: Interruption length X**

|  |  |  |
| --- | --- | --- |
|  | **NR Slot** | **Interruption length X (slots)** |
|  | **length (ms)** |  |
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |

**Table 8.2D.1.2.7-2: Parameters which cause interruption other than SCS**

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

8.2D.1.2.8 Interruptions due to UE-specific CBW change

When an ATG UE receives an RRC reconfiguration that changes *offsetToCarrier* or *carrierBandwidth*, the ATG UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its CBW. X is defined in table 8.2D.1.2.8-1. The interruption is only allowed within the delay TRRCprocessingDelay + TCBWchangeDelayRRC defined in clause 8.13D.

**Table 8.2D.1.2.8-1: interruption length X**

|  |  |  |
| --- | --- | --- |
|  | **NR Slot** | **Interruption length X (slots)** |
|  | **length (ms)** |  |
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |

8.2D.1.2.9 Interruptions when identifying CGI of an NR cell with autonomous gaps

When an ATG UE is identifying CGI of an NR cell with autonomous gaps, the ATG 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 8.2D.1.2.9-1 for each interruption during MIB decoding time period TMIB (ms) specified in clause 9.11D.

- with up to L1 interruptions with interrupted slots up to interruption length Y1 specified in table 8.2D.1.2.9-1 for each interruption during SIB1 decoding time period TSIB1 (ms) specified in clause 9.11D 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 8.2D.1.2.9-1 for each interruption during SIB1 decoding time period TSIB1 (ms) specified in clause 9.11D for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3.

Where:

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

- L1 = TSIB1/20and

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

**Table 8.2D.1.2.9-1: 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 |

8.2D.1.2.10 Interruptions at NR SRS antenna port switching

The requirements in this clause are applicable to ATG UE SRS antenna port switching on FR1 and SRS resource(s) is only configured within the last 6 symbols of a slot. For interruption caused by SRS antenna port switching, the victim cell is based on the entry number of the band indicated by *txSwitchImpactToRx*. DL interruption is allowed on any of the serving cells as indicated in *txSwitchImpactToRx*.

The ATG UE shall perform SRS antenna port switching only if the below conditions are met.

- the SRS switching is not colliding with any NR measurements (i.e. SSB/CSI-RS based L1/L3 measurements) and the measurements for RLM/BFD/CBD if the serving cell on which the NR measurements and the measurements for RLM/BFD/CBD is performed is a victim cell based on *txSwitchImpactToRx* or is the same carrier on which SRS is transmitted.

No requirements are defined for SRS antenna port switching if aperiodic SRS switching is colliding with aperiodic L1-RSRP/L1-SINR measurements and the serving cell on which the aperiodic L1-RSRP/L1-SINR measurement is configured is indicated in *txSwitchImpactToRx* or is the same carrier on which aperiodic SRS is scheduled/configured.

When 1 SRS symbol is configured in a slot for SRS antenna switching, the interruption requirement in table 8.2D.1.2.10-1 applies. For the rest of SRS configurations, the interruption requirement in table 8.2D.1.2.10-2 applies.

**Table 8.2D.1.2.10-1: Interruption length in symbols of victim CC when 1 SRS symbol is configured**

|  |  |  |
| --- | --- | --- |
| **Victim cell SCS(kHz)** | **Aggressor cell SCS (kHz)** | |
| **15** | **30** |
| 15 | 3 | 2 |
| 30 | 4 | 3 |

**Table 8.2D.1.2.10-2: Interruption length in slots of victim CC for rest of the SRS configurations**

|  |  |  |
| --- | --- | --- |
| **Victim cell SCS(kHz)** | **Aggressor cell SCS (kHz)** | |
| **15** | **30** |
| 15 | 2 | 2 |
| 30 | 2 | 2 |

**<End of change#7>**

**<Start of change#8>**

## 8.3D SCell Activation and Deactivation Delay for ATG

### 8.3D.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to activate at least one deactivated SCell and deactivate at least one activated SCell in standalone NR carrier aggregation.

### 8.3D.2 SCell Activation Delay Requirement for Deactivated SCell

The requirements in this clause shall apply for the UE configured with at least one downlink SCell in standalone NR carrier aggregation and when one SCell is being activated.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot , where:

THARQ (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

Tactivation\_time is the SCell activation delay in milliseconds.

If the SCell is known and belongs to FR1, Tactivation\_time is:

- TFirstSSB+ 5 ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.

- TFirstSSB\_MAX + Trs + 5 ms, if the measurement period of the SCell being activated is larger than 2400 ms.

If the SCell is unknown and belongs to FR1, and if one of the following conditions is met

- ‘ssb-PositionInBurst’ indicates only one SSB is being actually transmitted, or

- ‘ssb-PositionInBurst’ indicates multiple SSBs and TCI indication is provided in same MAC PDU with SCell activation,

provided that the side condition Ês/Iot ≥ -2 dB is fulfilled, Tactivation\_time is:

- If UE supports *shortMeasInterval-r18*, then

- TFirstSSB\_MAX, enhanced + TSMTC\_MAX, enhanced + Trs, enhanced + 5 ms, if the following conditions are met,

- the SCell is contiguous to an active serving cell in the same band, and

- its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and

- its SMTC offset is same as the one of contiguous FR1 active serving cell, and

- its RTD with contiguous FR1 active serving cell is smaller than or equal to 260 ns with respect to the to-be-activated SCell’s SSB numerology, and its reception power difference with contiguous FR1 active serving cell is smaller than or equal to 6 dB;

- TFirstSSB\_MAX, enhanced + TSMTC\_MAX, enhanced + 2\*Trs, enhanced + 5 ms, otherwise.

- Otherwise

- TFirstSSB\_MAX + TSMTC\_MAX + Trs + 5 ms, if the following conditions are met,

- the SCell is contiguous to an active serving cell in the same band, and

- its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and

- its SMTC offset is same as the one of contiguous FR1 active serving cell, and

- its RTD with contiguous FR1 active serving cell is smaller than or equal to 260 ns, and its reception power difference with contiguous FR1 active serving cell is smaller than or equal to 6 dB;

- TFirstSSB\_MAX + TSMTC\_MAX + 2\*Trs + 5 ms, otherwise.

Otherwise, provided that the side condition Ês/Iot ≥ -2 dB is fulfilled, Tactivation\_time is:

- If UE supports *shortMeasInterval-r18*, then

- 6 ms + TFirstSSB\_MAX, enhanced + TSMTC\_MAX, enhanced + Trs, enhanced + TL1-RSRP, enhanced\_measure + TL1-RSRP, report + THARQ + max(Tuncertainty\_MAC + TFineTiming + 2 ms, Tuncertainty\_SP), if semi-persistent CSI-RS is used for CSI reporting,

- 3 ms + TFirstSSB\_MAX, enhanced + TSMTC\_MAX, enhanced + Trs, enhanced + TL1-RSRP, enhanced\_measure + TL1-RSRP ,report + max(THARQ + Tuncertainty\_MAC + 5 ms + TFineTiming, Tuncertainty\_RRC + TRRC\_delay), if periodic CSI-RS is used for CSI reporting.

- Otherwise

- 6 ms + TFirstSSB\_MAX + TSMTC\_MAX + Trs + TL1-RSRP, measure + TL1-RSRP,report + THARQ + max(Tuncertainty\_MAC + TFineTiming + 2 ms, Tuncertainty\_SP), if semi-persistent CSI-RS is used for CSI reporting,

- 3 ms + TFirstSSB\_MAX + TSMTC\_MAX + Trs + TL1-RSRP, measure + TL1-RSRP,report + max(THARQ + Tuncertainty\_MAC + 5 ms + TFineTiming, Tuncertainty\_RRC + TRRC\_delay), if periodic CSI-RS is used for CSI reporting.

- However, when the following conditions are fulfilled, no activation requirement will be applied for this unknown SCell:

- the SCell is contiguous to an active serving cell in the same band, and

- A single SSB is used in the unknown SCell; or multiple SSBs are used in the SCell and TCI state indication for PDCCH is provided by the same MAC PDU used for SCell activation; and

- its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and

- its SMTC offset is same as the one of contiguous FR1 active serving cell

- its RTD with contiguous FR1 active serving cell is larger than 260 ns, or its reception power difference with contiguous FR1 active serving cell is larger than 6 dB;

If the SCell being activated belongs to FR1 and if there is at least one active serving cell contiguous to the SCell on that FR1 band, if the UE is not provided with SSB configuration (*absoluteFrequencySSB*) or SMTC configuration for the target SCell, Tactivation\_time is 3 ms for UE supporting *scellWithoutSSB*, provided

- The RTD between the target SCell and the contiguous active serving cell is within ±260ns, and

- The difference of the reception power with the contiguous active serving cell is <= 6 dB, and

- The RS(s) of SCell being activated is (are) QCL-TypeA with TRS(s) of the SCell being activated, and the TRS(s) of the SCell being activated is (are) further QCL-TypeC with SSB(s) of any active serving cell that is contiguous to the SCell being activated on that FR1 band.

For a UE supporting *scellWithoutSSB-InterBandCA-r18* if the SCell being activated belongs to FR1 and if the UE is not provided with SSB configuration (*absoluteFrequencySSB*) in the target SCell (FrequencyInfoDL) nor SMTC configuration for the target SCell, and if there is one collocated active reference serving cell on different FR1 band, when the following conditions are fulfilled,

- The RTD between the target SCell and the collocated reference serving cell is within CP where CP is corresponding to the SCS of SSB-less SCell, and

- The EPRE difference at the UE is smaller than or equal to [30] dB, where EPRE difference is the power difference between TRS/A-TRS symbol on the SSB-less SCell and SSB symbol on the reference serving cell normalized by SCSs of SSB of reference cell and A-TRS/P-TRS of SSB-less SCell, and

- The RS(s) of the SSB-less SCell being activated is (are) QCL-TypeA with TRS(s) of the SSB-less SCell being activated, and the TRS(s) of the SSB-less SCell being activated is (are) further QCL-TypeC with SSB(s) of an inter-band active serving cell, and the inter-band active serving cell shall be same as the reference serving cell.

where the reference serving cell can be indicated by higherlayer parameter *referenceCell-r18*. If UE is not indicated with *referenceCell-r18*, the reference serving cell is assumed to be the QCL-typeC source cell if there is only one active QCL-typeC source cell configured.

Tactivation\_time is

- Tfirst\_TRS + TTRS +5 ms, if aperiodic CSI-RS resources are not configured for SCell activation or UE do not support *aperiodicCSI-RS-FastScellActivation-r17*, when the the EPRE difference is smaller than or equal to 12 dB

- Tfirst\_ATRS + Tgap + TATRS + 5 ms if aperiodic CSI-RS resources are configured for SCell activation for UE supporting *aperiodicCSI-RS-FastScellActivation-r17*, when the the EPRE difference is smaller than or equal to 12 dB

- Tfirst\_TRS + 2\*TTRS +5 ms, when the EPRE difference is larger than 12 dB but smaller than or equal to [30] dB

where,

TSMTC\_MAX:

- In FR1, in case of intra-band contiguous SCell activation, TSMTC\_MAX is the longer SMTC periodicity between active serving cells and SCell being activated provided the cell specific reference signals from the active serving cells and the SCells being activated or released are available in the same slot; in case of inter-band SCell activation, TSMTC\_MAX is the SMTC periodicity of SCell being activated.

- TSMTC\_MAX is bounded to a minimum value of 10 ms.

TSMTC\_MAX, enhanced:

- In FR1, a UE supporting *shortMeasInterval-r18* if the SMTC for SCell being activated is only configured in measObjectNR, TSMTC\_MAX, enhanced is the SSB periodicity of SCell being activated. Otherwise, TSMTC\_MAX, enhanced = TSMTC\_MAX.

Trs is the SMTC periodicity of the SCell being activated if the UE has been provided with an SMTC configuration for the SCell in SCell addition message, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing.If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement which involves Trs is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There are no requirements if the SSB transmission periodicity is not 5 ms.

Trs, enhanced is the SSB periodicity of the SCell being activated for a UE supporting *shortMeasInterval-r18* in FR1, if the SMTC for SCell being activated is only configured in the *measObjectNR*. Otherwise, Trs, enhanced = Trs

TFirstSSB: is the time to the end of the first complete SSB burst indicated by the SMTC, or within 5 ms if SMTC is not configured, after slot n + .

TFirstSSB\_MAX: Is the time to the end of the first complete SSB burst indicated by the SMTC, or within 5 ms if SMTC is not configured, after slot n + , further fulfilling:

- In FR1, in case of intra-band contiguous SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCell being activated is transmitting SSB burst.

TFirstSSB\_MAX, enhanced: For a UE supporting *shortMeasInterval-r18* in FR1, if the SMTC for SCell being activated is only configured in the measObjectNR, TFirstSSB\_MAX, enhanced is the time to the end of the first complete SSB burst indicated by the SSB periodicity of the SCell being activated, after slot n + . Otherwise, TFirstSSB\_MAX, enhanced = TFirstSSB\_MAX

TFineTiming is the time period between UE finish processing the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and the timing of first complete available SSB corresponding to the TCI state.

TL1-RSRP, measure is L1-RSRP measurement delay TL1-RSRP\_Measurement\_Period\_SSB or TL1-RSRP\_Measurement\_Period\_CSI-RS based on applicability as defined in clause 9.5D assuming M=1 and TReport=0.

TL1-RSRP, enhanced\_measure is

- SSB based L1-RSRP measurement delay TL1-RSRP\_Measurement\_Period\_SSB based on applicability as defined in clause 9.5D assuming M=1 and TReport=0; N is equal to the value reported by the UE in *reduceForSSB-L1-RSRP-Meas*. Otherwise, if *reduceForSSB-L1-RSRP-Meas* is absent, N= 8. Or,

- CSI-RS based L1-RSRP measurement delay TL1-RSRP\_Measurement\_Period\_CSI-RS based on applicability as defined in clause 9.5D assuming M=1 and TReport=0.

- If UE supports *shortMeasInterval-r18* capability, L1-RSRP measurement for TL1-RSRP, enhanced\_measure can be performed based on non-DRX mode even if DRX is configured.

TL1-RSRP, report is delay of acquiring CSI reporting resources.

Tuncertainty\_MAC is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable) relative to

- SCell activation command for known case;

- First valid L1-RSRP reporting for unknown case.

Tuncertainty\_RRC is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) relative to

- SCell activation command for known case;

- First valid L1-RSRP reporting for unknown case.

Tuncertainty\_SP is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting relative to

- SCell activation command for known case;

- First valid L1-RSRP reporting for unknown case.

TTRS is the periodicity of periodic CSI-RS burst for SCell activation.

TATRS is the CSI-RS burst for SCell activation where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots.

Tgap is a gap length between two aperiodic CSI-RS bursts,

- at least 2 slots for 15 kHz and 30 kHz

- at least 3 slots for 60 kHz

SCell in FR1 is known if it has been meeting the following conditions:

- During the period equal to max(5\*measCycleSCell,  5\*DRX cycles) for FR1 before the reception of the SCell activation command:

- the UE has sent a valid measurement report for the SCell being activated and

- the SSB measured remains detectable according to the cell identification conditions specified in clause 9.2D and 9.3D.

- the SSB measured during the period equal to max(5\*measCycleSCell, 5\*DRX cycles) also remains detectable during the SCell activation delay according to the cell identification conditions specified in clause 9.2D and 9.3D.

Otherwise SCell in FR1 is unknown.

If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2*prior to the activation command, TSMTC\_Scell follows *smtc1* or *smtc2* according to the physical cell ID of the target cell being activated. TSMTC\_MAX follows *smtc1* or *smtc2* according to the physical cell IDs of the target cells being activated and the active serving cells.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.331 [2] for a SCell at the first opportunities for the corresponding actions once the SCell is activated.

The starting point of an interruption window on Pcell or any activated SCell, as specified in clause 8.2D, shall not occur before slot n+1+ and not occur after slot slot n+1+, where NR slot length is with respect to the numerology used in the SCell being activated, and TX is:

- 0, if Tactivation\_time is 3 ms;

- TFirstSSB, for any scenario where Tactivation\_time includes TFirstSSB;

- TFirstSSB\_MAX, for any scenario where Tactivation\_time includes TFirstSSB\_MAX;

- Tuncertainty\_MAC +TFineTiming, for any scenario where Tactivation\_time includes only TFineTiming and no TFirstSSB\_MAX;

- Tfirst\_TRS, for FR1 inter-band SSB-less SCell activation scenario where Tactivation\_time includes Tfirst\_TRS;

- Tfirst\_ATRS, for FR1 inter-band SSB-less SCell activation scenario where Tactivation\_time includes Tfirst\_ATRS.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

The requirements in this clause and requirements on interruption due to SCell activation in clause 8.2D apply provided that the SSB of the to-be-activated SCell is within the first active DL BWP of the SCell.

### 8.3D.3 SCell Deactivation Delay Requirement for Activated SCell

The requirements in this clause shall apply for the UE configured with at least one downlink SCell in standalone NR carrier aggregation and when one SCell is being deactivated.

Upon receiving SCell deactivation command in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot *n +*. The starting point of an interruption window on PCell or any activated SCell, as specified in clause 8.2D, shall not occur before slot n+1+ and not occur after slot n+1+, where NR slot length is with respect to the numerology used in the SCell being deactivated.

Upon expiry of the *sCellDeactivationTimer* in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot *n +*. The starting point of an interruption window on Pcell or any activated SCell, as specified in clause 8.2D, shall not occur before slot n+1 and not occur after slot n+1+, where NR slot length is with respect to the numerology used in the SCell being deactivated.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

### 8.3D.4 Direct SCell Activation at SCell addition

The requirements in this clause apply for UE being configured in the RRC reconfiguration message, TS 38.331 [2], with one SCell for which the parameter *sCellState* is set to *activated*.

If the RRC reconfiguration message for direct SCell activation also configures TCI state information, the requirements in clause 8.3D.2 based on that TCI state activation command is received at the same time as SCell activation command shall apply.

The UE shall configure the SCell in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. The UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCell no later than in slot ,

where:

- Slot n is the last slot overlapping with the PDSCH containing the RRC reconfiguration message,

- Ndirect = TRRC\_Process + T1 + Tactivation\_time + TCSI\_Reporting - 3 ms for the cases specified in clause 8.3D.2 that TCI state is not indicated within Tactivation\_time; otherwise, Ndirect = TRRC\_Process + T1 + THARQ + Tactivation\_time + TCSI\_Reporting

*-* TRRC\_Process: RRC procedure delay as specified in clause 12 of TS 38.331 [2],

*-* T1: Delay from slot until the transmission of *RRCReconfigurationComplete* message,

NOTE: *T1* is UE implementation dependent.

*THARQ* (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3],

If the SCell is known and belongs to FR1, *TCSI\_Reporting* is specified in clause 8.3D.2 and *Tactivation\_time* is defined as:

- TFirstSSB+ 5 ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.

- TFirstSSB\_MAX + Trs + 5 ms, if measurement period of the SCell being activated is larger than 2400 ms.

where,

the measurement period in table 9.2D.5.2-1 applies if the target SCell was in an intra-frequency layer corresponding to an activated SCell;

the measurement period in table 9.2D.5.2-2 applies if the target SCell was in an intra-frequency layer corresponding to a deactivated SCell;

the measurement period in table 9.3D.5-1 applies if the target SCell was in an inter-frequency layer.

*-* Otherwise, Tactivation\_time and TCSI\_Reporting are specified in clause 8.3D.2, where the following definitions of TFirstSSB and TFirstSSB\_MAX shall override the existing ones:

- TFirstSSB: the time to the end of the first complete SSB burst indicated by the SMTC after slot n +

- TFirstSSB\_MAX: the time to the end of the first complete SSB burst indicated by the SMTC after slot n +

- In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCell being activated is transmitting SSB burst.

*-* If a UE supports, *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* and/or *shortMeasInterval-r18* capabilities*,* the reduced Tactivation\_time specified in clause 8.3D.2 when UE supports these capabilities is applicable for Direct SCell activation at SCell addition also.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The SCell in FR1 is known provided the following conditions are met for the SCell:

-During the last 5 seconds before the reception of the direct SCell configuration command:

-the UE has sent a valid measurement report for the SCell being directly activated, and

-the SSB measured remains detectable according to the cell identification conditions specified in clauses 9.2D and 9.3D,

-the SSB measured during the period equal to [5] seconds also remains detectable during the SCell activation delay according to the cell identification conditions specified in clause 9.2D and 9.3D.

Otherwise, the SCell is unknown.

The UE may be allowed to cause interruptions to serving cells on other component carriers during an interruption window, as specified in clause 8.2D. The starting point of an interruption window on Pcell or any activated SCell shall not occur before slot *n*+1, and shall not occur after slot *n+*1+, where NR slot length is with respect to the numerology of the SCell being activated, and *TX* is:

- *TFirstSSB*, for any scenario where *Tactivation\_time*includes *TFirstSSB*;

- *TFirstSSB\_MAX*, for any scenario where *Tactivation\_time*includes *TFirstSSB\_MAX*;

- *Tuncertainty\_MAC +TFineTiming*, for any scenario where *Tactivation\_time*includes *TFineTiming*.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

### 8.3D.5 Direct SCell Activation at Handover

The requirements in this clause apply for UE being configured in the RRC reconfiguration message, TS 38.331 [2], for handover with one SCell for which the parameter *sCellState* is set to *activated*.

The UE shall configure the SCell in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. The UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCell no later than in slot ,

Where:

- Slot n is the last slot overlapping with the PDSCH containing RRC reconfiguration message.

- Ndirect = TRRC\_process + Tinterrupt + T2 + T3 + Tactivation\_time + TCSI\_Reporting - 3 ms for the cases specified in clause 8.3D.2 that TCI state is not indicated within Tactivation\_time; otherwise, Ndirect = TRRC\_process + Tinterrupt + T2 + T3 + THARQ +Tactivation\_time + TCSI\_Reporting

- TRRC\_Process: RRC procedure delay as specified in clause 12 of TS 38.331 [2],

- Tinterrupt: Interruption time during handover as specified in clause 6.1E.1,

- T2: Delay from slot until UE has obtained a valid TA command for the target PCell,

- T3: Delay for applying the received TA for uplink transmission in the target PCell, and greater than or equal to k+1 slot, where k is defined in clause 4.2 in TS 38.213 [3],

- *THARQ* (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3],

*-* If the SCell is known and belongs to FR1, *TCSI\_Reporting* is specified in clause 8.3D.2 and *Tactivation\_time* is defined as:

- TFirstSSB+ 5 ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.

- TFirstSSB\_MAX + Trs + 5 ms, if measurement period of the SCell being activated is larger than 2400 ms.

where,

the measurement period in table 9.2D.5.2-1 applies if the target SCell was in an intra-frequency layer corresponding to an activated SCell;

the measurement period in table 9.2D.5.2-2 applies if the target SCell was in an intra-frequency layer corresponding to a deactivated SCell;

the measurement period in table 9.3D.5-1 applies if the target SCell was in an inter-frequency layer.

- Otherwise, *Tactivation\_time* and *TCSI\_Reporting* are specified in clause 8.3D.2, where the following definitions of *TFirstSSB* and *TFirstSSB\_MAX*shall override the existing ones:

- TFirstSSB: the time to the end of the first complete SSB burst indicated by the SMTC after slot n +

- TFirstSSB\_MAX: the time to the end of the first complete SSB burst indicated by the SMTC after slot n +

- In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCell being activated is transmitting SSB burst.

- If a UE supports, *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* and/or *shortMeasInterval-r18* capabilities*,* the reduced Tactivation\_time specified in clause 8.3D.2 when UE supports these capabilities is applicable for Direct SCell activation at handover also.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The SCell in FR1 is known provided the following conditions are met for the SCell:

- During the last 5 seconds before the reception of the direct SCell configuration command:

- the UE has sent a valid measurement report for the SCell being directly activated, and

- the SSB measured remains detectable according to the cell identification conditions specified in clauses 9.2D and 9.3D,

- the SSB measured during the period equal to [5] seconds also remains detectable during the SCell activation delay according to the cell identification conditions specified in clause 9.2D and 9.3D.

Otherwise, the SCell is unknown.

The UE may be allowed to cause interruptions to PCell during an interruption window, as specified in clause 8.2D. The starting point of an interruption window on PCell shall not occur before slot *n*+1+, and not occur after slot *n*+1+, where NR slot length is with respect to the numerology of the SCell being activated, and *TX* is:

- *TFirstSSB*, for any scenario where *Tactivation\_time*includes *TFirstSSB*;

- *TFirstSSB\_MAX*, for any scenario where *Tactivation\_time*includes *TFirstSSB\_MAX*;

- *Tuncertainty\_MAC +TFineTiming*, for any scenario where *Tactivation\_time*includes *TFineTiming*.

The length of the interruption window depends on the frequency band relation between the aggressor SCell and the victim PCell.

### 8.3D.6 Direct SCell Activation at RRC Resume

The requirements in this clause apply for UE being configured in the RRC reconfiguration message in TS 38.331 [2] for RRC Resume with one SCell for which the parameter *sCellState* is set to *activated*.

The requirements in clause 8.3D.4 shall apply, except that the definition of *T1* shall be deemed to be replaced with

*T1*: Delay from slot until the transmission of RRCResumeComplete message,

### 8.3D.7 Fast SCell Activation Delay Requirement for Deactivated SCell

Aperiodic CSI-RS resources can be configured for fast SCell activation. The requirements in this clause shall apply for the UE configured with one downlink SCell in standalone NR carrier aggregation and when one SCell is being activated. The requirements in this clause shall apply for the UE provided with aperiodic CSI-RS resources for SCell activation for the target SCell.

NOTE: If UE is allocated A-TRS for fast SCell activation, the UE is not required to use the SSB of the target SCell.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot , where:

THARQ (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

Tactivation\_time is the SCell activation delay in milliseconds.

If the SCell is known and belongs to FR1, Tactivation\_time is:

- TFirstATRS+ 5 ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.

- TFirstATRS + Tgap + TATRS + 5 ms, if the measurement period of the SCell being activated is larger than 2400 ms.

NOTE: The RSs on the activated serving cell in the same band are not required to be transmitted in the same slot as the temporary RS.

NOTE: UE may report inaccurate non-zero CQI for any activated Cell and being activated SCell during the fast SCell activation procedure only if the RSs on the activated serving cell in the same band are not transmitted in the same slot as the aperiodic CSI-RS for fast SCell activation.

If the SCell is unknown and belongs to FR1, and SCell is contiguous to an active serving cell in the same band, provided that the side condition Ês/Iot ≥ -2 dB is fulfilled, Tactivation\_time is:

- TFirstATRS + Tgap + TATRS + 5 ms, if the following conditions are met,

- the SCell is contiguous to an active serving cell in the same band, and

- its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and

- its SMTC offset is same as the one of contiguous FR1 active serving cell, and

- its RTD with contiguous FR1 active serving cell is smaller than or equal to 260 ns with respect to the to-be-activated SCell’s SSB numerology, and its reception power difference with contiguous FR1 active serving cell is smaller than or equal to 6 dB;

NOTE: The RSs on the activated serving cell in the same band are not required to be transmitted in the same slot as the temporary RS.

NOTE: UE may report inaccurate non-zero CQI for any activated SCell and being activated SCell during the fast SCell activation procedure only if the RSs on the activated serving cell in the same band are not transmitted in the same slot as the aperiodic CSI-RS for fast SCell activation.

where,

TFirstATRS: is the time to the end of the first complete CSI-RS burst for SCell activation after slot n + , where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots.

TATRS is the CSI-RS burst for SCell activation where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots.

- Tgap is a gap length between two aperiodic CSI-RS bursts,

- at least 2 slots for 15 kHz and 30 kHz

- at least 3 slots for 60 kHz

TCSI\_reporting is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

SCell in FR1 is known if it has been meeting the following conditions:

- During the period equal to max(5\*measCycleSCell,  5\*DRX cycles) for FR1 before the reception of the SCell activation command:

- the UE has sent a valid measurement report for the SCell being activated and

- the SSB measured remains detectable according to the cell identification conditions specified in clauses 9.2D and 9.3D.

- the SSB measured during the period equal to max(5\*measCycleSCell, 5\*DRX cycles) also remains detectable during the SCell activation delay according to the cell identification conditions specified in clauses 9.2D and 9.3D.

Otherwise SCell in FR1 is unknown.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.331 [2] for a SCell at the first opportunities for the corresponding actions once the SCell is activated.

The starting point of an interruption window on PCell or any activated SCell, as specified in clause 8.2D, shall not occur before slot n+1+ and not occur after slot slot n+1+, where NR slot length is with respect to the numerology used in the SCell being activated, and TX is:

- TFirstATRS, for any scenario where Tactivation\_time includes TFirstATRS;

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

The requirements in this clause and requriements on interruption due to SCell activation in clause 8.2D apply provided that the SSB and A-TRS of the to-be-activated SCell is within the first active DL BWP of the Scell.

Starting from slot *n* + THARQ + 3 ms where slot *n* is the slot where SCell activation command is received (as specified in clause 4.3 of TS 38.213 [3]) and until the SCell activation completion at UE, after at least one CSI-RS transmission occasion for the channel measurement and reporting (specified in clause 5.2.2.5 of TS 38.214 [26]).

### 8.3D.8 SCell Activation Delay Requirement for Deactivated SCell with the L3 reporting during activation

The requirements in this clause shall apply for UE supporting *l3-MeasUnknownSCellActivation-r18* and reporting valid L3 measurement results after receiving the SCell activation command for unknown SCell. The requirements in this clause shall apply for the UE configured with one downlink SCell in NR carrier aggregation and when one SCell is being activated. clause 8.3D.2 is applied for UE who does not report L3 measurement results after receiving SCell activation command for unknown SCell.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot , where:

THARQ (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

Tactivation\_time is the SCell activation delay in milliseconds.

- Tactivation\_time is:

- 10 ms + TL3,report+ THARQ + max(Tuncertainty\_MAC + TFineTiming + 2 ms, Tuncertainty\_SP), if semi-persistent CSI-RS is used for CSI reporting,

- 7 ms + TL3,report+ max(THARQ + Tuncertainty\_MAC + 5 ms + TFineTiming, Tuncertainty\_RRC + TRRC\_delay), if periodic CSI-RS is used for CSI reporting,

If the following conditions are met:

If the SCell being activated belongs to FR1 and if there is no active serving cell contiguous to the SCell on that FR1 band provided that the side condition Ês/Iot ≥ -2 dB is fulfilled:

If the target SCell belongs to FR1 and none of the following conditions is met

- ‘ssb-PositionInBurst’ indicates only one SSB is being actually transmitted, or

- ‘ssb-PositionInBurst’ indicates multiple SSBs and TCI indication is provided in same MAC PDU with SCell activation;

Otherwise, Tactivation\_time in clause 8.3D.2 is applied for unknown SCell activation.

However, when the following conditions are fulfilled, no activation requirement will be applied for this unknown SCell:

- the SCell is contiguous to an active serving cell in the same band, and

- a single SSB is used in the unknown SCell; or multiple SSBs are used in the SCell and TCI state indication for PDCCH is provided by the same MAC PDU used for SCell activation; and

- its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and

- its SMTC offset is same as the one of contiguous FR1 active serving cell

- its RTD with contiguous FR1 active serving cell is larger than 260 ns with respect to the to-be-activated SCell’s SSB numerology, or its reception power difference with contiguous FR1 active serving cell is larger than 6 dB;

where,

TL3, report is delay of acquiring the first available UL resource for L3 reporting from 7 ms +THARQ after receiving SCell activation command.

- The L3 measurement reporting requirement is defined in clause [9.2.4.4]

- UE is ready to report the L3 measurement result no later than 7 ms + THARQ ms from receiving the SCell activation command.

UE is not required to report the L3 results after 3 ms + THARQ+ M ms from receiving the SCell activation command where

- For FR1,

- M=2\*TSSB + TL1-RSRP,report for UE supporting *shortMeasInterval-r18* capability,

- Otherwise, M =TSMTC +TSSB + TL1-RSRP,report

Where, X1 and X2 are UE capabilities as reported in *reduceForCellDetection* and *reduceForSSB-L1-RSRP-Meas* respectively. TSSB is the same as Trs, enhanced as specified in clause 8.3D.2. TSMTC is the same as TSMTC\_MAX as specified in clause 8.3D.2.

TFineTiming is the time period between UE finish processing the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and the timing of first complete available SSB corresponding to the TCI state.

Tuncertainty\_MAC is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable) relative to

- First valid L3-RSRP reporting for unknown case, if UE reports valid L3-RSRP before receiving TCI activation command

- First valid L1-RSRP reporting for unknown case, if UE reports valid L3-RSRP after receiving TCI activation command

Tuncertainty\_RRC is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) relative to

- First valid L3-RSRP reporting for unknown case, if UE reports valid L3-RSRP before receiving TCI activation command

- First valid L1-RSRP reporting for unknown case, if UE reports valid L3-RSRP after receiving TCI activation command

Tuncertainty\_SP is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting relative to

- First valid L3-RSRP reporting for unknown case, if UE reports valid L3-RSRP before receiving TCI activation command

- First valid L1-RSRP reporting for unknown case, if UE reports valid L3-RSRP after receiving TCI activation command

TRRC\_delay is the RRC procedure delay as specified in TS 38.331 [2].

Longer delays for RRM measurement requirements, can be expected during the cell detection time for unknown SCell activation.

When *absoluteFrequencySSB* is not configured in *DownlinkConfigCommon* for target SCell but SMTC for target SCell is configured, no requirement would be applied.

TCSI\_reporting is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

SCell in FR1 is known if it has been meeting the following conditions:

- During the period equal to max(5\*measCycleSCell,  5\*DRX cycles) for FR1 before the reception of the SCell activation command:

- the UE has sent a valid measurement report for the SCell being activated and

- the SSB measured remains detectable according to the cell identification conditions specified in clause 9.2D and 9.3D.

- the SSB measured during the period equal to max(5\*measCycleSCell, 5\*DRX cycles) also remains detectable during the SCell activation delay according to the cell identification conditions specified in clauses 9.2D and 9.3D.

Otherwise SCell in FR1 is unknown.

The requirement for unknown SCell applies provided that the activation commands for PDCCH TCI, PDSCH TCI (when applicable), semi-persistent CSI-RS for CQI reporting (when applicable), and configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) are based on the latest valid L3-RSRP reporting or either L1-RSRP reporting or L3-RSRP reporting when UE report both L3-RSRP reporting and L1-RSRP reporting before receiving TCI activation command.

If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*prior to the activation command, TSMTC\_Scell follows *smtc1* or *smtc2* according to the physical cell ID of the target cell being activated. TSMTC\_MAX follows *smtc1* or *smtc2* according to the physical cell IDs of the target cells being activated and the active serving cells.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.331 [2] for a SCell at the first opportunities for the corresponding actions once the SCell is activated.

The starting point of an interruption window on PCell or any activated SCell, as specified in clause 8.2D, shall not occur before slot n+1+ and not occur after slot slot n+1+, where NR slot length is with respect to the numerology used in the SCell being activated, and TX is:

- Tuncertainty\_MAC +TFineTiming, for any scenario where Tactivation\_time includes only TFineTiming and no TFirstSSB\_MAX.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

The requirements in this clause and requriements on interruption due to SCell activation in clause 8.2D apply provided that the SSB of the to-be-activated SCell is within the first active DL BWP of the Scell.

**<End of change#8>**

**<Start of change#9>**

#### 8.5D.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set estimated over the last TEvaluate\_BFD\_SSB period becomes worse than the threshold Qout\_LR\_SSB within TEvaluate\_BFD\_SSB period.

The value of TEvaluate\_BFD\_SSB is defined in table 8.5D.2.2-1 for FR1.

For FR1 ATG UE with one or multiple omni-directional antenna(s),

- , when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB.

- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR1 ATG UE with the antenna array,

- P value for an BFD-RS resource to be measured is defined as:

- Psharing factor \* Ntotal / Noutside\_MG with Navailable = 0

- Ntotal / Navailable with Navailable > 0

- For a window W of duration max(TL1, MGRPmax), where MGRPmax is the maximum MGRP across all configured per-UE measurement gaps starting at the beginning of any BFD-RS resource occasion:

- Ntotal is the total number of BFD-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- Navailable is

- the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion of same serving cell within the window W if inter-band carrier aggregation within FR1 is configured [and UE doesn’t support capability of case 4],

- otherwise, the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W.

- TL1 is periodicity of the target BFD-RS

- Psharing factor = 3.

**<End of change#9>**

**<Start of change#10>**

#### 8.5D.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the CSI-RS resource in set estimated over the last TEvaluate\_BFD\_CSI-RS period becomes worse than the threshold Qout\_LR\_CSI-RS within TEvaluate\_BFD\_CSI-RS period.

The value of TEvaluate\_BFD\_CSI-RS is defined in table 8.5D.3.2-1 for FR1.

The requirements of TEvaluate\_BFD\_CSI-RS apply provided that the CSI-RS for BFD is not in a resource set configured with repetition ON. The requirements shall not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for BFD and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR1 ATG UE with one or multiple omni-directional antenna(s),

- , when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS.

- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR1 ATG UE with the antenna array,

- P value for an BFD-RS resource to be measured is defined as:

- Psharing factor \* Ntotal / Noutside\_MG with Navailable = 0

- Ntotal / Navailable with Navailable > 0

- For a window W of duration max(TL1, MGRPmax), where MGRPmax is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:

- Ntotal is the total number of BFD-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- Navailable is

- the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion of same serving cell within the window W if inter-band carrier aggregation within FR1 is configured [and UE doesn’t support capability of case 4],

- otherwise, the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W.

- TL1 is periodicity of the target BFD-RS.

- Psharing factor = 3.

**<End of change#10>**

**<Start of change#11>**

#### 8.5D.5.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in set estimated over the last TEvaluate\_CBD\_SSB period becomes better than the threshold Qin\_LR provided SSB\_RP and SSB Ês/Iot are according to annex B.2.4.1 for a corresponding band.

The UE shall monitor the configured SSB resources using the evaluation period in table 8.5D.5.2-1 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320 ms.

The value of TEvaluate\_CBD\_SSB is defined in table 8.5D.5.2-1 for FR1.

where,

For FR1 ATG UE with one or multiple omni-directional antenna(s),

- , when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB,

- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR1 ATG UE with the antenna array,

- P value for an CBD-RS resource to be measured is defined as:

- Psharing factor \* Ntotal / Noutside\_MG with Navailable = 0

- Ntotal / Navailable with Navailable > 0

- For a window W of duration max(TL1, MGRPmax), where MGRPmax is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CBD-RS resource occasion:

- Ntotal is the total number of CBD-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- Navailable is

- the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion of same serving cell within the window W if inter-band carrier aggregation within FR1 is configured [and UE doesn’t support capability of case 4],

- otherwise, the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W.

- TL1 is periodicity of the target CBD-RS

- Psharing factor = 3.

**<End of change#11>**

**<Start of change#12>**

#### 8.5D.6.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured CSI-RS resource in set estimated over the last TEvaluate\_CBD\_CSI-RS period becomes better than the threshold Qin\_LR within TEvaluate\_CBD\_CSI-RS period provided CSI-RS Ês/Iot is according to annex B.2.4.2 for a corresponding band.

The UE shall monitor the configured CSI-RS resources using the evaluation period in table 8.5D.6.2-1 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320 ms.

The value of TEvaluate\_CBD\_CSI-RS is defined in table 8.5D.6.2-1 for FR1.

For FR1 ATG UE with one or multiple omni-directional antenna(s),

- , when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR1 ATG UE with the antenna array,

- P value for an CBD-RS resource to be measured is defined as:

- Psharing factor \* Ntotal / Noutside\_MG with Navailable = 0

- Ntotal / Navailable with Navailable > 0

- For a window W of duration max(TL1, MGRPmax), where MGRPmax is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CBD-RS resource occasion:

- Ntotal is the total number of CBD-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- Navailable is

- the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion of same serving cell within the window W if inter-band carrier aggregation within FR1 is configured [and UE doesn’t support capability of case 4],

- otherwise, the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W.

- TL1 is periodicity of the target CBD-RS

- Psharing factor = 3.

**<End of change#12>**

**<Start of change#13>**

#### 8.5D.7.2 Scheduling availability of UE performing beam failure detection with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to beam failure detection when SSB is configured as BFD. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to beam failure detection when SSB is configured as BFD.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for beam failure detection.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on FR1 serving PCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) in the bands due to beam failure detection performed on FR1 serving PCell in different bands.

**<End of change#13>**

**<Start of change#14>**

#### 8.5D.8.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as link recovery detection resource. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured as link recovery detection resource.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH, TRS, CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for L1-RSRP.

When intra-band carrier aggregation in FR1 is performed, the scheduling restrictions on FR1 serving PCell applies to all serving cells in the same band on the symbols that fully or partially overlap with the restricted symbols.

When inter-band carrier aggregation within FR1 is performed, there are no scheduling restrictions on FR1 serving cell(s) in the bands due to candidate beam detection performed on FR1 serving PCell in different bands.

**<End of change#14>**

**<Start of change#15>**

#### 8.5D.10 Requirements for Beam Failure Recovery in SCell

The requirement in clause 8.5.9 shall apply.

**<End of change#15>**

**<Start of change#16>**

## 8.6D Active BWP switch delay for ATG

### 8.6D.1 Introduction

The requirements in this clause apply for an ATG UE configured PCell or any activated SCell in standalone NR. The requirements in this clause also apply for a UE configured with more than one BWP on PCell. UE shall complete the switch of active DL and/or UL BWP within the delay defined in this clause.

UE shall complete the switch of active DL and/or UL BWP within the delay defined in this clause.

### 8.6D.2 DCI and timer based BWP switch delay

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

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) 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 8.6D.2-1.

Table 8.6D.2-1: BWP switch delay

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | BWP switch delay TBWPswitchDelay (slots) | |
| Type 1Note 1 | Type 2Note 1 |
| 0 | 1 | 1 | 3 |
| 1 | 0.5 | 2 | 5 |
| 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 8.10D or 8.15D in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in clause 8.10D or 8.15D in the new BWP

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

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 [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.

- 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.

### 8.6D.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.

#### 8.6D.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 7.6D.2.

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 8.6D.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 shall 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* [14] for switching between non-dormant BWPs, and *bwp-SwitchingMultiDormancyCCs-r16* or *bwp-SwitchingMultiDormancyCC-DCI-0-3-And-1-3-r18* for switching between non-dormant and dormant BWPs.

- If no BWP switch involves SCS change, N is the number of CCs in same FR; If 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,

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 8.10D in the new BWP.

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

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

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 [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.

- 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.

### 8.6D.2B Timer based BWP switch delay on multiple CCs

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

#### 8.6D.2B.1 Simultaneous timer based BWP switch delay on multiple CCs

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

For timer-based BWP switch on multiple CCs, UE shall start BWP switch at DL slot n, where slot n is the first slot of a DL subframe (in FR1) immediately after the earliest BWP-inactivity timer *bwp-InactivityTimer* [2] expiration occurs on multiple serving cells, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch on the first DL or UL slot occurs right after a time duration of TMultipleBWPswitchDelay which starts from the beginning of DL slot n, where TMultipleBWPswitchDelay is defined in clause 8.6D.2A.1.

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

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 8.10D in the new BWP.

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

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

#### 8.6D.2B.2 Non-simultaneous timer based BWP switch delay on multiple CCs

In non-simultaneous case, the timer-based BWP switch on multiple CCs is triggered over partially overlapping time period.

The delay requirements for non-simultaneous timer based BWP switch on multiple CCs in this clause apply if the timing difference among the beginning of the slot where timer based BWP switching starts for all CCs exceeds the MRTD for inter-band CA as defined in clause 7.6D.2, and the BWP switch does not involve SCS change. The UE performs the non-simultaneous timer-based BWP switch on the CCs sequentially.

For non-simultaneous timer-based BWP switch, 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 TMultipleBWPswitchDelayTotal which starts from the beginning of DL slot n, where slot n is the first slot of a DL subframe (in FR1) immediately after the earliest BWP-inactivity timer *bwp-InactivityTimer* [2] expires.

TMultipleBWPswitchDelayTotal = TDelay + TMultipleBWPswitchDelay

Where:

TDelay is the time required to complete the ongoing timer-based BWP switching on other CCs.

TMultipleBWPswitchDelay is the timer-based BWP switch delay on current single CC defined in clause 8.6D.2 or simultaneously triggered on multiple CCs defined in clause 8.6D.2B.1.

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

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 8.10D in the new BWP.

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

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

### 8.6D.3 RRC based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the BWP switch is performed on single CC from PCell with one or more than one BWP configuration(s) configured, with

- Active BWP switch or parameter change of its active BWPs for PCell

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

DL slot n is the last slot overlapping with the PDSCH containing the RRC command, and

is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch if the BWP switch involves changing of SCS.

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

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

The UE is not required to transmit UL signals or receive DL signals during the time defined by on PCell. When a longer switching delay is allowed. Where is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

### 8.6D.3A RRC based BWP switch delay on multiple CCs

The requirements in this clause only apply to the case when the same type of BWP switch (RRC based BWP switch) is performed on multiple CCs simultaneously.

The requirements in this clause shall apply:

* Active BWP switching or parameter change of its active BWPs for Pcell
* Parameter change of its active BWPs except parameter *firstActiveDownlinkBWP-Id* for SCells

#### 8.6D.3A.1 Simultaneous RRC based BWP switch delay on multiple CCs

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

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

DL slot n is the last slot overlapping with the PDSCH containing the RRC command, and

are defined in clause 8.6D.3, and

for UE which is capable of type 1 BWP switching delay depending on UE capability *bwp-SwitchingDelay* [2]. for UE which is capable of type 2 BWP switching delay depending on UE capability *bwp-SwitchingDelay* [2], where D is the incremental delay for each additional CC involved in simultaneous BWP switch and depends on UE capability [14].

N is the number of CCs within the NR-CA configured for performing simultaneous BWP switch.

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

**<End of change#16>**

**<Start of change#17>**

## 8.19D Pre-configured measurement gap activation/deactivation delay for ATG

### 8.19D.1 Introduction

The requirements in this clause apply for an ATG UE configured with PCell in standalone NR.

UE shall complete the activation/deactivation of pre-configured measurement gap within the delay defined in this clause.

### 8.19D.2 Pre-configured measurement gap activation/deactivation upon DCI/timer-based BWP switch

#### 8.19D.2.1 Activation/deactivation upon DCI/timer-based BWP switch delay on a single CC

The requirements in clause 8.19.2.1 shall apply only for FR1 and NR SA operation mode without considering DC and inter RAT measurement.

The requirements in this clause only apply to the case that the DCI/timer-based BWP switch is performed on a single CC with more than one BWP configurations configured on the CC.

When BWP switch occurs, which results in status change of pre-configured measurement gap according to clause 9.1D.7, UE shall be able to finish pre-configured activation or deactivation within 5 ms after the completion of the active BWP switch. The active BWP switch delay for single CC is defined in clause 8.6D.2. Activation/deactivation of Pre-MG takes effect from the first complete MG occasion after the activation and deactivation delay. If the end of activation/deactivation of Pre-MG is within a gap occasion, the Pre-MG status shall not be changed immediately. Instead, the Pre-MG status shall be changed prior to the next gap occasion.

### 8.19D.3 Pre-configured measurement gap activation/deactivation upon RRC reconfiguration

The requirements in clause 8.19.4 shall apply only for FR1 and NR SA operation mode without considering DC and inter RAT measurement.

The requirements in this clause apply when UE capable of autonomous activation/deactivation mechanism receives RRC reconfiguration to:

- Add/remove of any measurement object(s), or

- Switch active BWP or update parameters of its active BWP.

If the aforementioned RRC reconfiguration results in status change of pre-configured measurement gap according to clause 9.1D.7, UE shall be able to finish pre-configured activation or deactivation within 5 ms after RRC processing delay specified in [2]. If the end of activation/deactivation of Pre-MG is within a gap occasion, the Pre-MG status shall not be changed immediately. Instead, the Pre-MG status shall be changed prior to the next gap occasion.

### 8.19D.4 Pre-configured measurement gap activation/deactivation upon SCell activation/deactivation

The requirements in this clause apply when one SCell is activated/deactivated.

When one SCell is activated/deactivated, which results in status change of pre-configured measurement gap according to clause 9.1D.7, UE shall be able to finish pre-configured measurement gap activation or deactivation within 5 ms after the completion of SCell(s) activation/deactivation. The SCell(s) activation/deactivation delay is defined in clause 8.3D. Activation/deactivation of Pre-MG takes effect from the first complete MG occasion after the SCell(s) activation/deactivation delay. If the end of activation/deactivation of Pre-MG is within a Pre-MG gap occasion, the Pre-MG status shall not be changed immediately. Instead, the Pre-MG status shall be changed prior to the next Pre-MG gap occasion.

**<End of change#17>**

**<Start of change#18>**

## 9.1D General measurement requirement for ATG

### 9.1D.1 Introduction

This clause contains general requirements on the ATG UE regarding measurement reporting in RRC\_CONNECTED state. The requirements are split in intra-frequency, inter-frequency, and L1-RSRP measurements requirements. These measurements may be used by the NG-RAN. The measurement quantities are defined in TS 38.215 [4], the measurement model is defined in TS 38.300 [10], TS 37.340 [17] and measurement accuracies are specified in clause 10. Control of measurement reporting is specified in TS 38.331 [2].

In the requirements of clause 9.1D, the exceptions for side conditions apply as follows:

- for the UE capable of CA but not configured with any SCell, the applicable exceptions for side conditions are specified in Annex B, clause [B.3X.2.1] for UE supporting CA in FR1;

- for the UE capable of CA and configured with at least one SCell, the applicable exceptions for side conditions are specified in Annex B, clause [B.3X.2.2] for UE configured with CA in FR1;

### 9.1D.2 Measurement gap

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency 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.

During the per-UE measurement gaps an ATG UE, operating under SA mode (with single carrier or CA configured), is not required to conduct reception/transmission from/to the corresponding NR serving cells except the reception of signals used for RRM measurement(s).

UEs shall support the measurement gap patterns listed in table 9.1D.2-1 based on the applicability specified in table 9.1D.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.

Table 9.1D.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 |

Table 9.1D.2-2: Void

Table 9.1D.2-3: Applicability for Gap Pattern Configurations supported by the UE with NR standalone operation (with single carrier and NR CA configuration)

|  |  |  |  |
| --- | --- | --- | --- |
| Measurement gap pattern configuration | Serving cell | Measurement Purpose | Applicable Gap Pattern Id |
| Per-UE measurement gap | FR1 | FR1 | 0-11 |
| NOTE 1: Void  NOTE 2: Void  NOTE 3: Void  NOTE 4: 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. 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. | | | | |

For single carrier or CA with aligned frame boundaries,

For NR standalone operation (with single carrier or NR CA), total interruption time on a serving cell during MGL is defined when MGL(N) = 6 ms, 4 ms, 3 ms.

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

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

Figure 9.1D.2-1: Measurement GAP and total interruption time on serving cells for NR standalone operation (with single carrier and NR CA)

The corresponding total number of interrupted slots on serving cells is listed in table 9.1D.2-4 for all serving cells in synchronous NR standalone (with single carrier and NR CA configuration).

Table 9.1D.2-4: Total number of interrupted slots on all serving cells during MGL for Synchronous NR standalone operation (with single carrier and NR CA configuration) with per-UE measurement gap

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NR | Total number of interrupted slots on serving cells | | | | | |
| SCS | When MG timing advance of 0 ms is applied | | | When MG timing advance of 0.5 ms is applied | | |
| (kHz) | MGL=6 ms | MGL=4 ms | MGL=3 ms | MGL=6 ms | MGL=4 ms | MGL=3 ms |
| 15 | 6 | 4 | 3 | 7Note3 | 5Note3 | 4Note3 |
| 30 | 12 | 8 | 6 | 12 | 8 | 6 |
| 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 0 ms is applied, and (MGL+1) subframes when MG timing advance of 0.5 ms is applied.  NOTE 2: Void  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. | | | | | | |

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 15 kHz, 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 15 kHz, 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).

#### 9.1D.2.1a SA: Measurement Gap Sharing

Measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on intra-frequency carriers or when SMTC configured for intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE requires measurement gaps to identify and measure cells on inter-frequency carriers for both SSB and CSI-RS based L3 measurement, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-UE measurement gaps.

When network signals “01”, “10” or “11” with RRC parameter *MeasGapSharingScheme* [2] and the value of X is defined as in table 9.1D.2.1A-1, and

- Kintra = 1 / X \* 100,

- Kinter = 1 / (100 – X) \* 100,

When network signals “00” indicating equal splitting gap sharing, X is not applied.

The RRC parameter *MeasGapSharingScheme* shall be applied to the calculation of carrier specific scaling factor as specified in clause 9.1D.5.2.2.

Table 9.1D.2.1A-1: Value of parameter X for NR standalone measurement gap sharing

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ | Equal splitting |
| ‘01’ | 25 |
| ‘10’ | 50 |
| ‘11’ | 75 |
| NOTE: It is left to UE implementation to determine which measurement gap sharing scheme in the table to be applied, when *MeasGapSharingScheme* is absent and there isno stored value in the field. | |

### 9.1D.3 UE Measurement capability

#### 9.1D.3.1 SA: Monitoring of multiple layers using gaps

When monitoring of multiple inter-frequency NR carriers is configured by PCell, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, CSI-SINR etc.) of detected cells on all the layers configured for measurements by the PCell.

#### 9.1D.3.2 SA: Maximum allowed layers for multiple monitoring

The UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by PCell, and

- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by PCell.

The number of SSB frequency layers equals to the total number of MOs with

- *ssb-ConfigMobility* configured, or

- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB*.

If *ssbfrequency, smtc1, smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

The number of CSI-RS frequency layers equals to the number of MOs with *csi-rs-ResourceConfigMobility* configured assuming single MO is configured per frequency layer.

### 9.1D.4 Void

### 9.1D.5 Carrier-specific scaling factor

This clause specifies the derivation of carrier-specific scaling factor (CSSF) values, which scales the measurement delay requirements given in clause 9.2D, 9.3D, and CSI-RS based L3 measurement in clause 9.10D when UE is configured to monitor multiple measurement objects. The CSSF values are categorized into CSSFoutside\_gap,i andCSSFwithin\_gap,i, for the measurements conducted outside measurement gaps and within measurement gaps, respectively.

#### 9.1D.5.1 Monitoring of multiple layers outside gaps

The carrier-specific scaling factor CSSFoutside\_gap,i for measurement object *i* derived in this chapter is applied to following measurement types:

- SSB-based intra-frequency measurement with no measurement gap in clause 9.2D.5, when none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- SSB-based intra-frequency measurement with no measurement gap in clause 9.2D.5, when part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- CSI-RS based intra-frequency measurement in clause 9.10D.2, when none of CSI-RS resources for L3 measurement of this intra-frequency measurement object are overlapped by the measurement gap.

- CSI-RS based intra-frequency measurement in clause 9.10D.2, when all CSI-RS resources for L3 measurement of this intra-frequency measurement object are partially overlapped by the measurement gap.

- SSB-based inter-frequency measurement with no measurement gap in clause 9.3D.9, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- SSB-based inter-frequency measurement with no measurement gap in clause 9.3D.9, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

The UE is expected to conduct the measurement of this measurement object *i* only outside the measurement gaps.

The number of frequency layers for SSB measurements shall include the total number of MOs with

- *ssb-ConfigMobility* configured, or

- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB*.

If *ssbfrequency, smtc1, smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, CSSFoutside\_gap,i and requirements derived from CSSFoutside\_gap,i are not specified.

##### 9.1D.5.1.1 Void

##### 9.1D.5.1.2 SA mode: carrier-specific scaling factor for SSB-based, CSI-RS based L3 measurements performed outside gaps

The carrier-specific scaling factor CSSFoutside\_gap,i for intra-frequency SSB-based measurements, inter-frequency SSB-based measurements performed outside measurements gaps, intra-frequency CSI-RS L3 measurement with no measurement gap is specified in table 9.1D.5.1.2-1.

Table 9.1D.5.1.2-1: CSSFoutside\_gap,i scaling factor for SA mode

|  |  |  |  |
| --- | --- | --- | --- |
| Scenario | *CSSF*outside\_gap,i for FR1 PCC | *CSSF*outside\_gap,i for FR1 SCC | *CSSF*outside\_gap,i for inter-frequency MO with no measurement gap |
| **FR1 single carrier** | 1+NPCC\_CSIRS | N/A | Y |
| **FR1 only CA** | 1+NPCC\_CSIRS | NSCC\_SSB +Y +2x NSCC\_CSIRS | NSCC\_SSB +Y +2x NSCC\_CSIRS |
| NOTE 1: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.  NOTE 2: NPCC\_CSIRS=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, NPCC\_CSIRS =0.  NOTE 3: CSSFoutside\_gap,i =1 if only one SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on SCC; CSSFoutside\_gap,i =2 if only one SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on SCC.  NOTE 4: NSCC\_CSIRS=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured  NOTE 5: NSCC\_SSB=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG. | | | |

#### 9.1D.5.2 Monitoring of multiple layers within gaps

The carrier-specific scaling factor CSSFwithin\_gap,i for a measurement object *i* derived in this chapter is applied to following measurement types:

- SSB-based intra-frequency measurement object with no measurement gap in clause 9.2D.5, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- SSB-based intra-frequency measurement object with measurement gap in clause 9.2D.6.

- CSI-RS based inter-frequency measurement in clause 9.10D.3, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are overlapped by the measurement gap.

- CSI-RS based inter-frequency measurement in clause 9.10D.3, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are partially overlapped by the measurement gap.

- SSB-based inter-frequency measurement object with measurement gap in clause 9.3D.4.

- SSB-based inter-frequency measurement object without measurement gap for UE capable of *interFrequencyMeas-NoGap* in clause 9.3D.9, when

- all of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, but the flag *interFrequencyConfig-NoGap-r16* is not configured by the Network.

The UE is expected to conduct the measurement of this measurement object *i* only within the measurement gaps.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, CSSFwithin\_gap,i and requirements derived from CSSFoutside\_gap,i are not specified.

Number of SSB layers shall include SSB for mobility and that as associated SSB for CSI-RS mobility. The ssbfrequency is counted only once if the ssbfrequency for mobility and associated SSB are the same, or ssbfrequency and smtc in multiple MOs are the same.

SSB-based measurement and CSI-RS based measurement for mobility configured in the same measurement object are considered as different layers.

##### 9.1D.5.2.1 Void

##### 9.1D.5.2.2 SA mode: carrier-specific scaling factor for SSB, CSI-RS-based L3 measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as CSSFwithin\_gap,i and is derived as described in this clause.

For each measurement gap *j*, count the total number of intra-frequency measurement objects and inter-frequency measurement objects on all frequency layers which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources is fully covered by the MGL excluding RF switching time.

- For UEs which are configured with per UE gaps the counting is done on a per UE basis.

- Mintra,i,j: Number of intra-frequency measurement objects, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise Mintra,i,j equals 0.

- Minter,i,j : Number of NR inter-frequency layers including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise Minter,i,j equals 0.

- Mtot,i,j = Mintra,i,j + Minter,i,j : Total number of intra-frequency layers, inter-frequency, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise Mtot,i,j equals 0.

The carrier specific scaling factor CSSFwithin\_gap,i is given by:

If *measGapSharingScheme* is equal sharing, CSSFwithin\_gap,i= max(ceil(Ri×Mtot,i,j)), where *j*=0…(160/MGRP)-1

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is an intra-frequency measurement object, CSSFwithin\_gap,i is the maximum among

- ceil(Ri×Kintra×Mintra,i,j) in gaps where Minter,i,j≠0, where *j*=0…(160/MGRP)-1

- ceil(Ri×Mintra,i,j) in gaps where Minter,i,j=0, where *j*=0…(160/MGRP)-1

- measurement object *i* is an inter-frequency measurement object on any one frequency layer, CSSFwithin\_gap,i is the maximum among

- ceil(Ri×Kinter×Minter,i,j) in gaps where Mintra,i,j ≠0, where *j*=0…(160/MGRP)-1

- ceil(Ri×Minter,i,j)in gaps where Mintra,i,j=0, where *j*=0…(160/MGRP)-1

Where Ri is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate to be measured.

### 9.1D.6 Void

### 9.1D.7 Pre-configured measurement gap

#### 9.1D.7.1 Introduction

A UE capable of Pre-configured measurement gap (Pre-MG) pattern can be configured with a Pre-MG pattern via RRC signalling [2].

The gap interruption requirements in clause 9.1D.2 apply to Pre-MG when Pre-MG is activated, and no gap interruption is expected when Pre-MG is deactivated.

- The requirements apply for NR standalone operation with single carrier and NR CA.

#### 9.1D.7.2 Requirements applicability

The requirements related to pre-configured measurement gap apply provided:

- UE indicates support of *preconfiguredUE-AutonomousMeasGap* [2] and/or *preconfiguredNW-ControlledMeasGap* [2], and

- a single per-UE measurement gap is pre-configured by the network, and

- one of measurement gap patterns among measurement gap patterns #0 ~ #11 is configured for pre-configured measurement gap, and

- UE is in NR SA with single carrier or with NR CA.

A measurement gap is configured as pre-configured measurement gap if *preConfigInd* is indicated by network in the configuration message of the measurement gap.

If UE indicates support of only *preconfiguredNW-ControlledMeasGap* [2], UE can expect the network to configure *preConfGapStatus*.

If a measurement gap is configured as pre-configured measurement gap, the applicability of measurement gap patterns is defined in table 9.1D.2-3.

If the Pre-MG status changes during a measurement period of a measurement that can be performed without and within measurement gaps, the UE is allowed to restart the measurement.

If the Pre-MG status changes from activated to deactivated during a measurement period of a measurement that can only be performed within measurement gaps, the measurement requirements do not apply.

#### 9.1D.7.3 Requirements

Any of the measurement Gap pattern defined in table 9.1D.2-1 can be configured as Pre-MG pattern.

The UE can determine the Pre-MG status based on autonomous activation/deactivation mechanism or based on network-controlled activation/deactivation mechanism.

A UE capable of both autonomous and network-controlled mechanisms for activation/deactivation of Pre-MG pattern will not use autonomous rules to determine the activation/deactivation status of the pre-configured MG if the network provides the activation/deactivation status via RRC indication *preConfGapStatus* for all the DL BWPs of all the activated CCs, and for all the deactivated SCCs..

##### 9.1D.7.3.1 Requirements for autonomous activation/deactivation mechanism

Requirements in this clause apply when autonomous mechanism [2] is used for activation/deactivation of Pre-MG pattern.

The UE can autonomously change the Pre-MG status from activation to deactivation or vice versa based on any of the following triggering conditions listed below. The UE shall also autonomously determine the Pre-MG status based on all the concurrent triggering conditions occurring jointly:

- DCI, timer or RRC based active BWP switching,

- Activation/deactivation of SCell(s),

- Addition/removal of any measurement object(s)

- Addition/release/change of a SCell in carrier aggregation,

The UE shall autonomously determine the status of the per-UE Pre-MG pattern as deactivated immediately after the configuration of the per-UE Pre-MG pattern or when any of the triggering conditions above is satisfied provided that all the configured measurements can be performed without measurement gaps.

A measurement can be performed by the UE without measurement gaps if any of the following conditions is met:

- The UE is configured with SSB based intra-frequency measurements, and the conditions defined for SSB based intra-frequency measurement without gaps in clause 9.2D.1 are met, or

- The UE is configured with SSB based inter-frequency measurements, and the conditions defined for SSB based inter-frequency measurement without gaps in clause 9.3D.1 are met, or

- The UE is configured with CSI-RS based intra-frequency measurements.

The UE shall autonomously determine the status of the per-UE Pre-MG pattern as activated immediately after the configuration of the per-UE Pre-MG pattern or when any of the triggering conditions above is satisfied provided that at least one of the configured measurements cannot be performed without measurement gaps.

A measurement cannot be performed by the UE without measurement gaps if any of the following conditions is met:

- The UE is configured with SSB based intra-frequency measurements, and the conditions defined for SSB based intra-frequency measurement without gaps in clause 9.2D.1 are not met, or

- The UE is configured with SSB based inter-frequency measurements, and the conditions defined for SSB based inter-frequency measurement without gaps in clause 9.3D.1 are not met, or

- The UE is configured with CSI-RS based inter-frequency measurements.

##### 9.1D.7.3.2 Requirements for network-controlled activation/deactivation mechanism

The requirements in this clause apply when network-controlled mechanism [2] is used for activation/deactivation of Pre-MG pattern.

For per-UE Pre-configured MG,

- the UE determines that the Pre-configured MG is activated if *preConfGapStatus* is set to ‘1’ for the corresponding gap ID for the active DL BWP of any of the activated CCs, or if *preConfGapStatus* is set to ‘1’ for the corresponding gap ID for any of the deactivated SCCs,,

- otherwise, the UE determines that the Pre-configured MG is deactivated

##### 9.1D.7.3.3 Requirements for reception/transmission during activation/deactivation

The requirements in this clause apply when autonomous mechanism or network-controlled mechanism is used for activation/deactivation [2] of Pre-MG pattern.

If per-UE Pre-MG pattern is activated then the UE is not required to conduct reception/transmission from/to the corresponding serving cells during the gap occasion according to the same principles as described for per-UE measurement gaps in clause 9.1D.2. Otherwise, the UE can be scheduled for reception/transmission of signals in all the serving cells during the gap occasion.

### 9.1D.8 Capabilities for Support of Event Triggering and Reporting Criteria

#### 9.1D.8.1 Introduction

This clause contains requirements on UE capabilities for support of event triggering and reporting criteria. As long as the measurement configuration does not exceed the requirements stated in clause 9.1D.8.2, the UE shall meet all other performance requirements defined in clause 9 and clause 10.

The UE can be requested to make measurements under different measurement identities defined in TS 38.331 [2]. Each measurement identity corresponds to either event-based reporting, periodic reporting, or no reporting. In case of event-based reporting, each measurement identity is associated with an event triggering criterion. In case of periodic reporting, a measurement identity is associated with one periodic reporting criterion. In case of no reporting, a measurement identity is associated with one no reporting criterion.

The purpose of this clause is to set some limits on the number of different event triggering, periodic, and no reporting criteria the UE may be requested to track in parallel.

#### 9.1D.8.2 Requirements

In this clause a reporting criterion corresponds to either one event (in the case of event-based reporting), or one periodic reporting criterion (in case of periodic reporting), or one no reporting criterion (in case of no reporting). For event-based reporting, each instance of event, with the same or different event identities, is counted as separate reporting criterion in table 9.1D.8.2-1.

The UE shall be able to support in parallel per category up to Ecat reporting criteria according to table 9.1D.8.2-1. For the measurement categories belonging to intra-frequency, inter-frequency, the UE need not support more than the total number of reporting criteria as follows:

- For UE configured with SA operation mode: , where

 is the total number of NR reporting criteria according to table 9.1D.8.2-1, and n is the number of configured NR serving frequencies, including PCell and SCell carrier frequencies.

Table 9.1D.8.2-1: Requirements for reporting criteria per measurement category

|  |  |  |
| --- | --- | --- |
| Measurement category | Ecat | Note |
| Intra-frequency Note 1,2 | 9 | Events for any one or a combination of intra-frequency SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, and CSI-SINR for NG-RAN intra-frequency cells |
| Inter-frequency Note 2 | 10 | Events for any one or a combination of inter-frequency SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, and CSI-SINR for NG-RAN inter-frequency cells |
| NOTE 1: When the UE is configured with SCell carrier frequencies, Ecat for Intra-frequency is applied per corresponding NR serving frequency.  NOTE 2: Applicable for UE configured with SA NR operation mode. | | |

### 9.1D.9 Minimum requirement at transitions

When the measurement on one intra-frequency measurement object transitions from measurements performed outside gaps to measurements performed within gaps or vice versa during one measurement period, the cell identification and measurement period requirements with the longer delay apply.

The carrier-specific scaling factor specified in clause 9.1D.5 that applies to the other impacted measurement objects will also apply based on the longer measurement or cell identification delay before or after the transition.

When the UE transitions between DRX and non-DRX or when DRX cycle periodicity changes, the cell identification and measurement period requirements apply based on the longer delay before or after the transition.

Subsequent to this measurement period, the cell identification and measurement period requirements on each measurement object are corresponding to the second mode after transition.

**<End of change#18>**

**<Start of change#19>**

## 9.2D NR intra-frequency measurements for ATG

### 9.2D.1 Introduction

A measurement is defined as a SSB based intra-frequency measurement provided the centre frequency of the SSB of the serving cell indicated for measurement and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSBs are also the same.

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell, even if no explicit neighbour list with physical layer cell identities is provided.

The UE can perform intra-frequency SSB based measurements without measurement gaps if

- the UE indicates ‘no-gap’ via *intraFreq-needForGap* for intra-frequency measurement, or

- the SSB is completely contained in the active BWP of the UE, or

- the active downlink BWP is initial BWP[3].

The UE can perform intra-frequency SSB based measurement corresponding to a deactivated SCell with NCSG.

For intra-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.2D.5.3. SSB based measurements are configured along with one or two measurement timing configuration(s) (SMTC(s)) which provides periodicity, duration and offset information on a window of up to 5 ms where the measurements are to be performed. For intra-frequency connected mode measurements, up to two measurement window periodicities may be configured. A single measurement window offset and measurement duration are configured per intra-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB and measure RSSI of RSRQ which start earlier than the gap starting time + switching time, nor detect SSB and measure RSSI of RSRQ which end later than the gap end – switching time. Switching time is 0.5 ms for frequency range FR1.

**<End of change#19>**

**<Start of change#20>**

### 9.2D.3 Number of cells and number of SSB

#### 9.2D.3.1 Requirements for FR1

For each intra-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 8 identified cells, and

- 14 SSBs with different SSB index and/or PCI on the intra-frequency layer, where the number of SSBs in the serving cell (except for the SCell) is not smaller than the number of configured RLM-RS SSB resources.

**<End of change#20>**

**<Start of change#21>**

### 9.2D.5 Intra-frequency measurements without measurement gaps

#### 9.2D.5.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within Tidentify\_intra\_without\_index if the UE is not indicated to report SSB based RRM measurement result with the associated SSB index(*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_with\_index. The UE shall be able to identify a new detectable intra-frequency SS block of an already detected cell within Tidentify\_intra\_without\_index.

Tidentify\_intra\_without\_index = (TPSS/SSS\_sync\_intra + TSSB\_measurement\_period\_intra) ms

Tidentify\_intra\_with\_index = (TPSS/SSS\_sync\_intra + TSSB\_measurement\_period\_intra + TSSB\_time\_index\_intra) ms

Where:

TPSS/SSS\_sync\_intra: it is the time period used in PSS/SSS detection given in table 9.2D.5.1-1 for the UE not capable of [intra/inter-band CA of ATG]. Otherwise, TPSS/SSS\_sync\_intra is given in tables 9.2D.5.1-1 or 9.2D.5.1-2 (deactivated SCell).

TSSB\_time\_index\_intra: it is the time period used to acquire the index of the SSB being measured given in table 9.2D.5.1-3 for the UE not capable of [intra/inter-band CA of ATG]. Otherwise, TSSB\_time\_index\_intra is given in tables 9.2D.5.1-3 or 9.2D.5.1-4 (deactivated SCell).

TSSB\_measurement\_period\_intra: equal to a measurement period of SSB based measurement given in table 9.2D.5.2-1.

CSSFintra: it is a carrier specific scaling factor and is determined according to CSSFoutside\_gap,i in clause 9.1D.5.1 for measurement conducted outside measurement gaps, i.e. when intra-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps, or according to CSSFwithin\_gap,i in clause 9.1D.5.2 for measurement conducted within measurement gaps, i.e. when intra-frequency SMTC is fully overlapping with measurement gaps.

For a UE that supports Pre-MG, an SMTC occasion is only considered to be overlapped by Pre-MG if the Pre-MG is activated.

If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

When UE supports *concurrentMeasGap-r17* and is configured with concurrent measurement gaps,

Kp is the scaling factor for an SSB frequency layer to be measured without measurement gaps. Kp = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

- For a window W of duration max(SMTC period, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gap, and starting from the beginning of any SMTC occasion:

- Ntotal is the total number of SMTC occasions within the window, including those overlapped with measurement gap occasions within the window, and

- Navailable is the number of SMTC occasions that are not overlapped with any non-dropped MG occasion within the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1.8.3.

Kp = 1 when Navailable = 0.

- Otherwise, when UE is not configured with or UE does not support concurrent measurement gaps:

When intra-frequency SMTC is fully non overlapping with measurement gaps or NCSG, or intra-frequency SMTC is fully overlapping with MGs or NCSG, Kp=1

When intra-frequency SMTC is partially overlapping with measurement gaps, Kp = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP. When intra-frequency SMTC is partially overlapping with NCSG, Kp = 1/(1- (SMTC period /VIRP)), where SMTC period < VIRP. For calculation of Kp, if the high layer signalling (TS 38.331 [2]) of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc1.* If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for Tidentify\_intra\_without\_index or Tidentify\_intra\_with\_index

For UE capable of *antennaArrayType-r18* on the measured carrier,

Klayer1\_measurement=1,

If inter-band carrier aggregation within FR1 is configured [and UE doesn’t support capability of case 4]

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap are not fully overlapped by intra-frequency SMTC occasions of the same serving cell,

Otherwise,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any serving frequency outside measurement gap are not fully overlapped by intra-frequency SMTC occasions

If the measured carrier is the SCC with servingcellMO configured, and the network indication [skippingSCCneighbourCellMeas] is set to‘enable’ to UE.

Klayer1\_measurement=1.5, otherwise.

Otherwise, Klayer1\_measurement=1.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

Table 9.2D.5.1-1: Time period for PSS/SSS detection, (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max( 600 ms, ceil(5 x Kp x N1Note 3,4 x Klayer1\_measurement) x SMTC period )Note 1 x CSSFintra |
| DRX cycle≤ 320 ms | max( 600 ms, ceil(1.5 x 5 x Kp x N1Note 3,4 x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320 ms | ceil(5 x Kp x N1 Note 3,4 x Klayer1\_measurement) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: void.  NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance information on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.  NOTE 4: For ATG UE capable of *antennaArrayType-r18*, for the SCC measurement, N1=1 when the network indication *[skippingSCCneighbourCellMeas]* is set to ‘enable’ to UE.  Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided. | |

Table 9.2D.5.1-2:Time period for PSS/SSS detection, deactivated SCC (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | Ceil(5 x Kp x N1Note 1,2) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320 ms | Ceil(5 x Kp x N1Note 1,2) x max(measCycleSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320 ms | Ceil(5 x Kp x N1Note 1,2) x max(measCycleSCell, DRX cycle) x CSSFintra |
| NOTE 1: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance information on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.  NOTE 2: For ATG UE capable of *antennaArrayType-r18*, for the SCC measurement, N1=1 when the network indication *[skippingSCCneighbourCellMeas]* is set to ‘enable’ to UE.  Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided. | |

Table 9.2D.5.1-3: Time period for time index detection (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(120 ms, ceil(3 x Kp x N1 Note 3,4 x Klayer1\_measurement)x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320 ms | max(120 ms, ceil (1.5 x 3 x Kp x N1 Note 3,4 x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320 ms | Ceil(3 x Kp x N1 Note 3,4 x Klayer1\_measurement) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: void  NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.  NOTE 4: For ATG UE capable of *antennaArrayType-r18*, for the SCC measurement, N1=1 when the network indication *[skippingSCCneighbourCellMeas]* is set to ‘enable’ to UE.  Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided. | |

Table 9.2D.5.1-4: Time period for time index detection, deactivated SCC (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | Ceil(3 x Kp x N1Note 1,2) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320 ms | Ceil(3 x Kp x N1Note 1,2) x max(measCycleSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320 ms | Ceil(3 x Kp x N1Note 1,2) x max(measCycleSCell, DRX cycle) x CSSFintra |
| NOTE 1: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance information on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.  NOTE 2: For ATG UE capable of *antennaArrayType-r18*, for the SCC measurement, N1=1 when the network indication *[skippingSCCneighbourCellMeas]* is set to ‘enable’ to UE.  Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided. | |

#### 9.2D.5.2 Measurement period

The measurement period for intra-frequency measurements without gaps is as shown in table 9.2D.5.2-1, 9.2D.5.2-2(CC with deactivated SCell).

If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for TSSB\_measurement\_period\_intra

For a UE that supports Pre-MG, an SMTC occasion is only considered to be overlapped by Pre-MG if the Pre-MG is activated.

Table 9.2D.5.2-1: Measurement period for intra-frequency measurements without gaps (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_measurement\_period\_intra |
| No DRX | max(200 ms, ceil( 5 x Kp x N1 Note 2,3 x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320 ms | max(200 ms, ceil(1.5x 5 x Kp x N1 Note 2,3 x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320 ms | ceil( 5 x Kp x N1 Note 2,3 x Klayer1\_measurement) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.  NOTE 3: For ATG UE capable of *antennaArrayType-r18*, for the SCC measurement, N1=1 when the network indication *[skippingSCCneighbourCellMeas]* is set to ‘enable’ to UE.  Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided. | |

Table 9.2D.5.2-2: Measurement period for intra-frequency measurements without gaps (CC with deactivated SCell) (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_measurement\_period\_intra |
| No DRX | Ceil(5 x Kp x N1 Note 2,3) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320 ms | Ceil(1.5x 5 x Kp x N1 Note 2,3) x max(measCycleSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320 ms | Ceil(5 x Kp x N1 Note 2,3) x max(measCycleSCell, DRX cycle) x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.  NOTE 3: For ATG UE capable of *antennaArrayType-r18*, for the SCC measurement, N1=1 when the network indication *[skippingSCCneighbourCellMeas]* is set to ‘enable’ to UE.  Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided. | |

#### 9.2D.5.3 Scheduling availability of UE during intra-frequency measurements

UE shall be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same serving carrier which can be merged[2], if it is configured; otherwise, all *L* SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

For a UE that supports Pre-MG, the requirements in clause 9.2D.5.3 also apply when a Pre-MG is deactivated.

##### 9.2D.5.3.1 Scheduling availability of UE performing measurements on FR1

When the ATG UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- If *deriveSSB-IndexFromCell* is enabled, the UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer in TS 38.331 [2] signalling of *smtc2*is configured, the SMTC periodicityfollows *smtc2*; Otherwise SMTC periodicity follows *smtc1.*

- If *deriveSSB-IndexFromCell* is not enabled, the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration. If the high layer in TS 38.331 [2] signalling of *smtc2*is configured, the SMTC periodicityfollows *smtc2*; Otherwise SMTC periodicity follows *smtc1.*

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When the ATG UE capable of *antennaArrayType-r18* performs intra-frequency neighbouring cell measurements, the following restrictions apply due to SS-RSRP or SS-SINR measurement:

- If *deriveSSB-IndexFromCell* is enabled, the UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows *smtc1*.

- If *deriveSSB-IndexFromCell* is not enabled, the UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration. If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

When intra-band carrier aggregation is performed and the ATG UE is capable of *antennaArrayType-r18*, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When inter-band carrier aggregation is performed and the ATG UE is capable of [common Rx beam between PCC band and SCC band], the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When the ATG UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRQ measurement

- If *deriveSSB-IndexFromCell* is enabled, the UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration. If the high layer signalling of *smtc2*is configured in TS 38.331 [2], the SMTC periodicityfollows *smtc2*; Otherwise the SMTC periodicity follows *smtc1.*

- If *deriveSSB-IndexFromCell* is not enabled, the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration. If the high layer signalling of *smtc2*is configured in TS 38.331 [2], the SMTC periodicityfollows *smtc2*; Otherwise the SMTC periodicity follows *smtc1.*

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When the ATG UE capable of *antennaArrayType-r18* performs intra-frequency neighbouring cell measurements, the following restrictions apply due to SS-RSRQ measurement:

- If *deriveSSB-IndexFromCell* is enabled, the UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration. If the high layer signaling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- If *deriveSSB-IndexFromCell* is not enabled, the UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration. If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

When intra-band carrier aggregation is performed and the ATG UE is capable of *antennaArrayType-r18*, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When inter-band carrier aggregation is performed and the ATG UE is capable of [common Rx beam between PCC band and SCC band], the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

##### 9.2D.5.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which does not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- 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 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer signalling of *smtc2*is configured(in TS 38.331 [2]), the SMTC periodicityfollows *smtc2*; Otherwise the SMTC periodicity follows *smtc1.*

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

If the following conditions are met:

- The UE has been notified about system information update through paging,

- The gap between the UE’s reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots

The UE shall receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and/or the corresponding PDSCH, on SSB symbols to be measured.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

**<End of change#21>**

**<Start of change#22>**

### 9.3D.9 Inter-frequency measurements without measurement gaps

#### 9.3D.9.1 Inter-frequency Cell identification

UE satisfying the applicability conditions specified in clause 9.3D.1 on the requirement in this clause shall be able to identify a new detectable inter-frequency cell within Tidentify\_inter\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured) or *deriveSSB-IndexFromCellInter-r17* is configured for the FR1 and UE supporting *deriveSSB-IndexFromCellInterNon-NCSG-r17*. Otherwise UE shall be able to identify a new detectable inter-frequency cell within Tidentify\_inter\_with\_index. The UE shall be able to identify a new detectable inter-frequency SS block of an already detected cell within Tidentify\_inter\_without\_index.

Tidentify\_inter\_without\_index = (TPSS/SSS\_sync\_inter + TSSB\_measurement\_period\_inter) ms

Tidentify\_inter\_with\_index = (TPSS/SSS\_sync\_inter + TSSB\_measurement\_period\_inter + TSSB\_time\_index\_inter) ms

Where:

- TPSS/SSS\_sync\_inter: it is the time period used in PSS/SSS detection given in table 9.3D.9.1-1.

- TSSB\_time\_index\_inter: it is the time period used to acquire the index of the SSB being measured given in table 9.3D.9.1-3.

- TSSB\_measurement\_period\_inter: equal to a measurement period of SSB based measurement given in table 9.3D.9.2-1.

- CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFoutside\_gap,i in clause 9.1D.5.1 for measurement conducted outside measurement gaps, i.e. when inter-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps or according to CSSFwithin\_gap,i in clause 9.1D.5.2 for measurement conducted within measurement gaps, i.e. when inter-frequency SMTC is fully overlapping with measurement gaps.

For inter-frequency SSB based measurements without measurement gaps in active BWP.

Mpss/sss\_sync\_inter: For FR1, Mpss/sss\_sync\_inter = 5.

MSSB\_index\_inter: For FR1, MSSB\_index\_inter = 3.

Mmeas\_period\_inter: For FR1, Mmeas\_period\_inter = 5.

Kp is a scaling factor for an SSB frequency layer to be measured without measurement gaps. Kp = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

For a window W of duration max(SMTC period, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE MG, and starting at the beginning of any SMTC occasion:

Ntotal is the total number of SMTC occasions within the window, including those overlapped with MG occasions within the window, and

Navailable is the number of SMTC occasions that are not overlapped with any non-dropped MG occasion within the window W, after accounting for MG collisions by applying the selected gap collision rule provided that concurrent measurement gaps are configured.

Kp = 1 when Navailable = 0.

Otherwise, when UE is not configured with or UE does not support concurrent measurement gaps:

When inter-frequency SMTC is fully non overlapping with measurement gaps, or inter-frequency SMTC is fully overlapping with MGs, Kp =1.

When inter-frequency SMTC is partially overlapping with measurement gaps, Kp = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP. When inter-frequency SMTC is partially overlapping with NCSG, Kp = 1/(1- (SMTC period /VIRP)), where SMTC period < VIRP.

For UE capable of *antennaArrayType-r18* on the measured carrier,

Klayer1\_measurement=1,

If inter-band carrier aggregation within FR1 is configured [and UE doesn’t support capability of case 4]

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap are not fully overlapped by inter-frequency SMTC occasions in the same band,

Otherwise,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any serving frequency outside measurement gap are not fully overlapped by inter-frequency SMTC occasions

Klayer1\_measurement=1.5, otherwise.

Otherwise, Klayer1\_measurement=1.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

For calculation of Kp, if the high layer signalling (TS 38.331 [2]) of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc1.*

Table 9.3D.9.1-1: Time period for PSS/SSS detection, (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max( 600 ms, ceil(Mpss/sss\_sync\_inter x Kp x N1 Note 4 x Klayer1\_measurement) x SMTC period )Note 1 x CSSFinter |
| DRX cycle≤ 320 ms | max( 600 ms, ceil(1.5x Mpss/sss\_sync\_inter x Kp x N1 Note 4 x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320 ms | ceil(Mpss/sss\_sync\_inter x Kp x N1 Note 4 x Klayer1\_measurement) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: Void  NOTE 3: Void  NOTE 4: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1. | |

Table 9.3D.9.1-2: void

Table 9.3D.9.1-3: Time period for time index detection (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_inter |
| No DRX | max(120 ms, ceil(MSSB\_index\_inter x Kp x N1 Note 4 x Klayer1\_measurement )x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320 ms | max(120 ms, ceil (1.5 x MSSB\_index\_inter x Kp x N1 Note 4 x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320 ms | Ceil(MSSB\_index\_inter x Kp x N1 Note 4 x Klayer1\_measurement) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: Void  NOTE 3: Void  NOTE 4: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1. | |

#### 9.3D.9.2 Measurement period

The UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4, 10.1.9, and 10.1.14, respectively, as shown in table 9.3D.9.2-1,if UE supports inter-frequency measurement without measurement gaps.

Table 9.3D.9.2-1: Measurement period for inter-frequency measurements without gaps ((FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_inter |
| No DRX | max(200 ms, ceil(Mmeas\_period\_inter x Kp x N1 Note 2 x Klayer1\_measurement) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320 ms | max(200 ms, ceil(1.5x Mmeas\_period\_inter x Kp x N1 Note 2 x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320 ms | ceil( Mmeas\_period\_inter x Kp x N1 Note 2 x Klayer1\_measurement) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1. | |

#### 9.3D.9.3 Scheduling availability of UE during inter-frequency measurements

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE is required to be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols to be measured in the following clauses are the SSB symbols indicated by *SSB-ToMeasure* [2], if it is configured; otherwise, all L SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

##### 9.3D.9.3.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When ATG UE performs inter-frequency measurements without measurement gaps in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- If *deriveSSB-IndexFromCellInter-r17* is enabled, UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

- If *deriveSSB-IndexFromCellInter-r17* is not enabled, UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When ATG UE capable of *antennaArrayType-r18* performs inter-frequency measurements without measurement gaps, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- If *deriveSSB-IndexFromCellInter-r17* is enabled, UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

- If *deriveSSB-IndexFromCellInter-r17* is not enabled, UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

When intra-band carrier aggregation is performed and the ATG UE is capable of *antennaArrayType-r18*, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When inter-band carrier aggregation is performed and the ATG UE is capable of [*common Rx beam between PCC band and SCC band*], the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When ATG UE performs inter-frequency measurements without measurement gaps, the following restrictions apply due to SS-RSRQ measurement

- If *deriveSSB-IndexFromCellInter-r17* is enabled, UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

- If *deriveSSB-IndexFromCellInter-r17* is not enabled, UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When ATG UE capable of *antennaArrayType-r18* performs inter-frequency measurements without measurement gaps, the following restrictions apply due to SS-RSRQ measurement

- If *deriveSSB-IndexFromCellInter-r17* is enabled, UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

- If *deriveSSB-IndexFromCellInter-r17* is not enabled, UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

When intra-band carrier aggregation is performed and the ATG UE is capable of *antennaArrayType-r18*, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When inter-band carrier aggregation is performed and the ATG UE is capable of [*common Rx beam between PCC band and SCC band*], the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

##### 9.3D.9.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology-Inter-r16* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If UE performs inter-frequency measurements without measurement gaps, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO i, and △t serving cell symbol before each consecutive SSB symbols to be measured and △t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if deriveSSB-IndexFromCellInter-r17 is enabled for MO i and UE supporting *deriveSSB-IndexFromCellInterNon-NCSG-r17*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9D, or

- serving cell symbols fully or partially overlap with SMTC window for MO i and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO i, or UE not supporting *deriveSSB-IndexFromCellInterNon-NCSG-r17*.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

**<End of change#22>**

**<Start of change#23>**

## 9.5D L1-RSRP measurements for Reporting for ATG

### 9.5D.1 Introduction

When configured by the network, the UE shall be able to perform L1-RSRP measurements of configured CSI-RS, SSB or CSI-RS and SSB resources for L1-RSRP. The measurements shall be performed for a serving cell, including PCell or SCell, on the resources configured for L1-RSRP measurements within the active BWP.

The UE shall be able to measure all CSI-RS resources and/or SSB resources of the *nzp-CSI-RS-ResourceSet* and/or *csi-SSB-ResourceSet* within the *CSI-ResourceConfig* settings configured for L1-RSRP for the active BWP, provided that the number of resources does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the *reportConfigType* according to the CSI reporting configuration(s) (*CSI-ReportConfig*) for the active BWP.

### 9.5D.2 Requirements applicability

The requirements in clause 9.5D apply, provided:

- The CSI-RS or SSB or CSI-RS and SSB resources configured for L1-RSRP measurements are measurable.

An SSB resource configured for L1-RSRP shall be considered measurable when for each relevant SSB the following conditions are met:

- L1-RSRP related side conditions given in clauses 10.1.19.1 for FR1, for a corresponding band,

- SSB\_RP and SSB Ês/Iot according to Annex B.2.4.1 for a corresponding band.

A CSI-RS resource configured for L1-RSRP shall be considered measurable when for each relevant CSI-RS the following conditions are met:

- L1-RSRP related side conditions given in clauses 10.1.19.2 for FR1, respectively, for a corresponding band,

- CSI-RS\_RP and CSI-RS Ês/Iot according to Annex B.2.4.2 for a corresponding band.

A CSI-RS and SSB resource configured for L1-RSRP shall be considered measurable when the measurable resource conditions are met for both CSI-RS resource and SSB resource.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

### 9.5D.3 Measurement Reporting Requirements

The UE shall send L1-RSRP reports only for report configurations configured for the active BWP.

The UE shall report the L1-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1 dB step size according to clause 10.1.19 for FR1 if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-RSRP based reporting as defined in clause 10.1.19 for FR1. The differential L1-RSRP is quantized to a 4-bit value with 2 dB step size. The mapping between the reported L1-RSRP value and the measured quantity is described in clause 10.1.6.

#### 9.5D.3.1 Periodic Reporting

Reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clauses 10.1.19 for FR1.

The UE shall only send periodic L1-RSRP measurement reports for an active BWP.

The UE shall transmit the periodic L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

#### 9.5D.3.2 Semi-Persistent Reporting

Reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clause 10.1.19 for FR1. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

#### 9.5D.3.3 Aperiodic Reporting

Reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clauses 10.1.19 for FR1.

The UE shall only send aperiodic L1-RSRP measurement reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

### 9.5D.4 L1-RSRP measurement requirements

#### 9.5D.4.1 SSB based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_SSB\_ATG.

The value of TL1-RSRP\_Measurement\_Period\_SSB\_ATG is defined in table 9.5D.4.1-1 for FR1, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

For ATG UE with the capable of *antennaArrayType-r18*,

P value for SSB resource to be measured is defined as

- Ntotal / Navailable with Navailable > 0

- Psharing factor \* Ntotal / Noutside\_MG with Navailable = 0

- For a window W of duration max(TL1, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any SSB resource occasion:

- Ntotal is the total number of SSB resource occasions within the window W, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is the number of SSB resource occasions that are not overlapped with any measurement gap occasion within the window W

- Navailable is

- the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion of same serving cell within the window W if inter-band carrier aggregation within FR1 is configured and UE does not support [*CommonRxBeam-r19*],

- otherwise, the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W

- TL1 is periodicity of the target SSB

- Psharing factor = 3.

Otherwise, for UE with one or multiple omni-directional antennas

For a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

- P value for SSB resource to be measured is defined as

- Ntotal / Noutside\_MG

- For a window W of duration max(TL1, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any SSB resource occasion:

- Ntotal is the total number of SSB resource occasions within the window W, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is

- the number of CSI-RS resource occasins that are not overlapped with any measurement gap occasion nor any SMTC occasion of same serving cell within the window W if inter-band carrier aggregation within FR1 is configured and UE does not support [*CommonRxBeam-r19*],

- otherwise, the number of SSB resource occasions that are not overlapped with any measurement gap occasion within the window W

- TL1 is periodicity of the target SSB.

Otherwise, for a UE not supporting *concurrentMeasGap-r17* or when concurrent gaps are not configured,

- P=, when in the monitored cell there are GAPs configured for intra-frequency or inter-frequency, which are overlapping with some but not all occasions of the SSB; and

- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the SSB.

Where:

- TSSB = *ssb-periodicityServingCell* of the serving cell

- an SSB or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and GAP configurations does not meet previous conditions.

Table 9.5D.4.1-1: Measurement period TL1-RSRP\_Measurement\_Period\_SSB\_ATG for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_ATG (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320 ms | ceil(M\*P)\*TDRX |
| NOTE: TSSB = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting. | |

#### 9.5D.4.2 CSI-RS based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_CSI-RS\_ATG.

- For periodic and semi-persistent CSI-RS resources, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

- For aperiodic CSI-RS resources M=1

For ATG UE capable of *antennaArrayType-r18*,

- P value for a CSI-RS resource to be measured is defined as

- Ntotal / Navailable with Navailable > 0

- Psharing factor \* Ntotal / Noutside\_MG with Navailable = 0

- For a window W of duration max(TL1, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CSI-RS resource occasion:

- Ntotal is the total number of CSI-RS resource occasions within the window W, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- Navailable is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W

- TL1 is periodicity of the target CSI-RS

- Psharing factor = 3.

Otherwise, for UE with one or multiple omni-directional antenna(s)

For a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

- P value for a CSI-RS resource to be measured is defined as

- Ntotal / Noutside\_MG in FR1

- For a window W of duration max(TL1, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CSI-RS resource occasion:

- Ntotal is the total number of CSI-RS resource occasions within the window W, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

TL1 is periodicity of the target CSI-RS.

Otherwise, for a UE not supporting *concurrentMeasGap-r17* or when concurrent gaps are not configured,

- P=, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the CSI-RS.

Where:

TCSI-RS = the periodicity of CSI-RS configured for L1-RSRP measurement

- a CSI-RS or an SMTC occasion is considered to be as overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

Table 9.5D.4.2-1: Measurement period TL1-RSRP\_Measurement\_Period\_CSI-RS\_ATG for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_CSI-RS\_ATG (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320 ms | ceil(M\*P)\*TDRX |
| NOTE 1: TCSI-RS is the periodicity of CSI-RS configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3. | |

### 9.5D.5 Measurement restriction for CSI-RS and SSB for L1-RSRP measurement

The UE is required to be capable of measuring SSB and CSI-RS for L1-RSRP without measurement gaps. The UE is required to perform the SSB and CSI-RS measurements with measurement restrictions as described in the following clauses.

#### 9.5D.5.1 Measurement restriction for SSB based L1-RSRP

For FR1, when the SSB for L1-RSRP measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;

- If SSB and CSI-RS have different SCS,

- If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;

- If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

#### 9.5D.5.2 Measurement restriction for CSI-RS based L1-RSRP

The SSB mentioned in this clause can be associated with the serving cell PCI.

For FR1, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for L1-RSRP measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for L1-RSRP measurement without any restriction.

### 9.5D.6 Scheduling availability of UE during L1-RSRP measurement

Scheduling availability restrictions described in the following clauses apply when the UE is performing L1-RSRP measurement on serving cell, and UE is receiving PDCCH/PDSCH from serving cell and/or cell(s) with different PCI.

#### 9.5D.6.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

#### 9.5D.6.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as RS for L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on serving cell where L1-RSRP measurement is performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which the serving cell where L1-RSRP measurement is performed is configured.

**<End of change#23>**

**<Start of change#24>**

## 9.8D L1-SINR measurements for Reporting for ATG

### 9.8D.1 Introduction

When configured by the network, the UE shall be able to perform L1-SINR measurements with the measurement resources configured as the selection of:

- CSI-RS based CMR and no dedicated IMR configured;

- SSB based CMR and dedicated IMR configured;

- CSI-RS based CMR and dedicated IMR configured.

The measurements shall be performed for a serving cell including PCell, or SCell, on the resources configured for L1-SINR measurements within the active BWP.

The UE shall be able to measure all CSI-RS resources and/or SSB resources and/or CSI-IM resources of the *nzp-CSI-RS-ResourceSet* and/or *csi-SSB-ResourceSet and/or CSI-IM-ResourceSet* within the *CSI-ResourceConfig* settings for L1-SINR for the active BWP and measure interference on corresponding NZP CSI-RS or CSI-IM resources if configured, provided that the number of resources does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the *reportConfigType* according to the CSI reporting configuration(s) (*CSI-ReportConfig*) for the active BWP.

### 9.8D.2 Requirements applicability

The requirements in clause 9.8D apply, provided:

- CMR resources configured for L1-SINR measurements are measurable, and

- NZP-IMR resources configured for L1-SINR measurements if applicable are measurable.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

For CSI-RS based CMR and no dedicated IMR configured, a CSI-RS resource configured for L1-SINR shall be considered measurable when for each relevant CSI-RS the following conditions are met:

- L1-SINR related side conditions given in clauses 10.1.27, respectively, for a corresponding band,

- CSI-RS\_RP and CSI-RS Ês/Iot according to Annex B.2.8.1 for a corresponding band.

For SSB based CMR and dedicated IMR configured, a SSB and a dedicated IMR configured for L1-SINR shall be considered measurable when for each relevant SSB and IMR the following conditions are met:

- L1-SINR related side conditions given in clauses 10.1.27, respectively, for a corresponding band,

- SSB\_RP and SSB Ês/Iot according to Annex B.2.8.2 for a corresponding band.

- NZP-IMR Ês/Iot according to Annex B.2.8.2 for a corresponding band, if NZP-IMR is configured as dedicated IMR.

For CSI-RS based CMR and dedicated IMR configured, a CSI-RS and a dedicated IMR configured for L1-SINR shall be considered measurable when for each relevant CSI-RS and IMR the following conditions are met:

- L1-SINR related side conditions given in clauses 10.1.27, respectively, for a corresponding band,

- CSI-RS\_RP and CSI-RS Ês/Iot according to Annex B.2.8.3 for a corresponding band

- NZP-IMR Ês/Iot according to Annex B.2.8.3 for a corresponding band, if NZP-IMR is configured as dedicated IMR.

### 9.8D.3 Measurement Reporting Requirements

The UE shall send L1-SINR reports only for report configurations configured for the active BWP.

The UE shall report the L1-SINR value as a 7-bit value in the range [-23, 40] dB with 0.5 dB step size if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-SINR based reporting. The differential L1-SINR is quantized to a 4-bit value with 1 dB step size. The mapping between the reported L1-SINR value and the measured quantity is described in clause 10.1.16.

#### 9.8D.3.1 Periodic Reporting

Reported L1-SINR measurements contained in periodic L1-SINR measurement reports shall meet the requirements in clauses 10.1.27.

The UE shall transmit the periodic L1-SINR reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

#### 9.8D.3.2 Semi-Persistent Reporting

Reported L1-SINR measurements contained in a Semi-Persistent L1-SINR measurement report shall meet the requirements in clause 10.1.27. This requirement applies for semi-persistent L1-SINR reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-SINR measurement reports on PUSCH, if a DCI for triggering report has been received.

The UE shall only send semi-persistent L1-SINR measurement reports on PUCCH, if an activation command as described in clause 6.1.3.16 in TS 38.321 [7] has been received.

The UE shall transmit the semi-persistent L1-SINR reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

#### 9.8D.3.3 Aperiodic Reporting

Reported L1-SINR measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-SINR reports shall meet the requirements in clauses 10.1.27.

The UE shall only send aperiodic L1-SINR measurement reports, if a DCI for triggering report has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-SINR reporting on PUSCH over the air interface at the time specified according to clause 5.2.1.4 in TS 38.214 [26].

### 9.8D.4 L1-SINR measurement requirements

#### 9.8D.4.1 L1-SINR reporting with CSI-RS based CMR and no dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the CSI-RS configured as CMR and no dedicated resource configured as IMR for L1-SINR computation, and the UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only\_ATG.

The value of TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only\_ATG is defined in table 9.8D.4.1-1 for FR1, where

For the value of M,

- For periodic and semi-persistent CSI-RS resources as CMR, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise;

- For aperiodic CSI-RS resources as CMR, M=1.

For ATG UE capable of *antennaArrayType-r18*,

P value for a CSI-RS resource to be measured is defined as

- Ntotal / Navailable with Navailable > 0

- Psharing factor \* Ntotal / Noutside\_MG with Navailable = 0

- For a window W of duration max(TL1, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CSI-RS resource occasion:

- Ntotal is the total number of CSI-RS resource occasions within the window W, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- Navailable is   
-the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion of same serving cell within the window W if inter-band carrier aggregation within FR1 is configured [and UE doesn’t support capability of case 4],  
  
-otherwise, the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W,

- TL1 is periodicity of the target CSI-RS

- Psharing factor = 3.

Otherwise, for UE with one or multiple omni-directional antenna(s)

For a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

- P value for a CSI-RS resource to be measured is defined as

- Ntotal / Noutside\_MG

- For a window W of duration max(TL1, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CSI-RS resource occasion:

- Ntotal is the total number of CSI-RS resource occasions within the window W, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- Noutside\_MG is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- TL1 is periodicity of the target CSI-RS.

Otherwise, for a UE not supporting *concurrentMeasGap-r17* or when concurrent gaps are not configured,

- P=, when in the monitored cell there are [measurement gaps] configured for intra-frequency or inter-frequency, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the CSI-RS.

Where:

- TCSI-RS = the periodicity of CSI-RS configured for L1-SINR measurement

- a CSI-RS is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*.

Note: The overlap between CSI-RS for L1-SINR measurement and SMTC means that CSI-RS for L1-SINR measurement is within the SMTC window duration.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and GAP configurations does not meet previous conditions.

Table 9.8D.4.1-1: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only\_ATG for FR1

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only\_ATG (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320 ms | ceil(M\*P)\*TDRX |
| NOTE 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3. | |

#### 9.8D.4.2 L1-SINR reporting with SSB based CMR and dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the SSB configured as CMR and dedicated resource configured as IMR for L1-SINR computation, in which the NZP-CSI-RS or CSI-IM resource configured as dedicated IMR shall be 1-to-1 mapped to SSB configured as CMR, with the same periodicity. The UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR\_ATG.

The requirements in this clause are not applicable if NZP-CSI-RS or CSI-IM resource configured as dedicated IMR is scheduled with different periodicity as SSB configured as CMR.

The value of TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR\_ATG is defined in table 9.8D.4.2-1, where

For the value of M

- For periodic or semi-persistent NZP CSI-RS or CSI-IM resource as dedicated IMR, M=1 if the higher layer parameters *timeRestrictionForChannelMeasurements* and/or *timeRestrictionForInterferenceMeasurements* are configured, and M=3 otherwise;

P is defined as the maximum value between PCMR and PIMR, i.e., P = max(PCMR, PIMR), where

- the value of PCMR shall be derived in the same way as the value of P used for SSB based L1-RSRP measurement in clause 9.5D.4.1, in which the occasions and period of the SSB for CMR shall be used instead.

- the value of PIMR shall be derived in the same way as the value of P used for CSI-RS based L1-RSRP measurement in clause 9.5D.4.2, in which the occasions and period of the NZP CSI-RS for NZP-IMR or CSI-IM for ZP-IMR shall be used instead.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet previous conditions.

For L1-SINR measurement with SSB as CMR and CSI-RS or CSI-IM as IMR, the requirement shall apply if the CSI-RS is configured as IMR with repetition field as “repetition = OFF” or CSI-IM is configured as IMR.

For L1-SINR measurement with SSB as CMR and CSI-RS/CSI-IM as IMR, no requirement shall apply if SSB occasions for CMR or CSI-RS/CSI-IM occasions for IMR are fully overlapped with the configured measurement gap

Table 9.8D.4.2-1: Measurement period TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR\_ATG for FR1

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR\_ATG (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320 ms | ceil(M\*P)\*TDRX |
| NOTE 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR channel measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  NOTE 2: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity. | |

#### 9.8D.4.3 L1-SINR reporting with CSI-RS based CMR and dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the CSI-RS resource configured as CMR and dedicated resource configured as IMR for L1-SINR computation, in which the NZP-CSI-RS or CSI-IM resource configured as dedicated IMR shall be 1-to-1 mapped to CSI-RS resource configured as CMR, with the same periodicity. The UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR\_ATG.

The requirements in this clause are not applicable if NZP-CSI-RS or CSI-IM resource configured as dedicated IMR is scheduled with different periodicity as CSI-RS resource configured as CMR.

The value of TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR\_ATG is defined in table 9.8D.4.3-1, where

For the value of M,

- M=1 shall be applied if

- aperiodic NZP-CSI-RS as CMR or dedicated IMR, or

- aperiodic CSI-IMR as dedicated IMR, or

- periodic and semi-persistent NZP-CSI-RS as CMR or dedicated IMR and the higher layer parameters *timeRestrictionForChannelMeasurement* and/or *timeRestrictionForInterferenceMeasurements* are configured, or

- periodic and semi-persistent CSI-IM as dedicated IMR and the higher layer parameters *timeRestrictionForChannelMeasurement* and/or *timeRestrictionForInterferenceMeasurements* are configured;

- M=3 otherwise.

P is defined as the maximum value between PCMR and PIMR, i.e., P = max(PCMR, PIMR), where

- The value of PCMR and PIMR shall be derived in the same way as the value of P used for CSI-RS based L1-RSRP measurement in clause 9.5D.4.2, in which the occasions and period of the CSI-RS for CMR and NZP CSI-RS for NZP-IMR or CSI-IM for ZP-IMR shall be used instead respectively.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet previous conditions.

For L1-SINR measurement with CSI-RS as CMR and CSI-RS as IMR, the requirement shall apply only if CSI-RS resources as CMR and IMR are configured with the same repetition field and the number of CSI-RS resources in the resource sets for CMR and IMR are same.

For L1-SINR measurement with CSI-RS as CMR and CSI-IM as IMR, the requirement shall apply only if the number of CSI-RS resources in the resource set for CMR and the number of CSI-IM resources in the resource set for IMR are same.

For L1-SINR measurement with CSI-RS as CMR and CSI-RS/CSI-IM as IMR, no requirement shall apply if CSI-RS occasions for CMR or CSI-RS/CSI-IM occasions for IMR are fully overlapped with the configured measurement gap.

Table 9.8D.4.3-1: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR\_ATG for FR1

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR\_ATG (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320 ms | ceil(M\*P)\*TDRX |
| NOTE 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.  NOTE 3: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity. | |

### 9.8D.5 Measurement restriction for L1-SINR measurement

The UE is required to be capable of measuring L1-SINR without measurement gaps. The UE is required to perform the SSB and CSI-RS/CSI-IM measurements with measurement restrictions as described in the following clauses.

#### 9.8D.5.1 Measurement restriction if SSB configured for L1-SINR Measurement

For FR1, when the SSB configured as CMR for L1-SINR measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-SINR measurement without any restriction;

- If SSB and CSI-RS have different SCS,

- If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-SINR measurement without any restriction;

- If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-SINR measurement and CSI-RS. Longer measurement period for SSB based L1-SINR measurement is expected, and no requirements are defined.

#### 9.8D.5.2 Measurement restriction if CSI-RS configured for L1-SINR measurement

When the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to receive CSI-RS for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement is within the active BWP and has same SCS than CSI-RS configured for L1-SINR measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement is within the active BWP and has different SCS than CSI-RS configured for L1-SINR measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to perform CSI-RS measurement without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and SSB. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE shall be able to measure the CSI-RS for L1-SINR measurement without any restriction.

#### 9.8D.5.3 Measurement restriction if CSI-IM configured for L1-SINR measurement

When the CSI-IM configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to measure CSI-IM for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR1, UE shall be able to measure the CSI-IM configured for L1-SINR measurement without any restriction.

### 9.8D.6 Scheduling availability of UE during L1-SINR measurement

Scheduling availability restrictions when the UE is performing L1-SINR measurement are described in the following clauses.

#### 9.8D.6.1 Scheduling availability of UE performing L1-SINR measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-SINR measurement performed on SSB and CSI-RS configured for L1-SINR measurement with the same SCS as PDSCH/PDCCH in FR1.

#### 9.8D.6.2 Scheduling availability of UE performing L1-SINR measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-SINR measurement based on SSB configured for L1-SINR measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-SINR measurement based on SSB configured for L1-SINR measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking /CSI-RS for CQI on SSB symbols to be measured for L1-SINR measurement.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on serving cell where L1-SINR measurement is performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which the serving cell where L1-SINR measurement is performed is configured.

**<End of change#24>**

**<Start of change#25>**

## 9.10D CSI-RS based L3 measurements for ATG

### 9.10D.1 Introduction

This clause contains general requirements on the ATG UE regarding CSI-RS based measurement reporting in RRC\_CONNECTED state. The requirements are split in intra-frequency and inter-frequency measurements requirements.

The requirements in this clause apply, provided:

- Only one MO is configured per CSI-RS frequency layer, and

- all CSI-RS resources in the same MO are configured with the same csi-rs-MeasurementBW, and

- *associatedSSB* is configured in *CSI-RS-Resource-Mobility* and detectable, and

- all CSI-RS resources in the same MO are configured with the same periodicity, and

- the number of CSI-RS resources in any duration that equals to the length of a slot is no larger than UE capability *maxNumberCSI-RS-RRM-RS-SINR*.

- When there are mixed numerologies, the length of a slot is defined based on the smallest SCS

### 9.10D.2 CSI-RS based intra-frequency measurements

#### 9.10D.2.1 Introduction

A measurement is defined as a CSI-RS based intra-frequency measurement provided that:

- the SCS of the CSI-RS resource of the neighbour cell configured for measurement is the same as the SCS of the CSI-RS resource on the serving cell indicated for measurement, and

- the CP type of the CSI-RS resource of neighbour cell configured for measurement is the same as the CP type of the CSI-RS resource of the serving cell indicated for measurement, and

- It is applied for SCS = 60KHz

- the centre frequency of the CSI-RS resource of the neighbour cell configured for measurement is the same as the centre frequency of the CSI-RS resource of the serving cell indicated for measurement

The UE shall be able to identify new intra-frequency cells and perform CSI-RSRP, CSI-RSRQ and CSI-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell.

No measurement gap is needed for intra-frequency CSI-RS resources measurements.

For intra-frequency CSI-RS based measurements, UE may cause scheduling restriction as specified in clause 9.10D.2.6.

Note: Extended CP for CSI-RS based measurement is not supported in this release.

#### 9.10D.2.2 Requirements applicability

The measurement of the associated SSB follows the same requirements as SSB based measurements defined in clause 9.2D.

The requirements in clause 9.10D.2 apply, provided:

- Only one intra-frequency CSI-RS layer per serving cell is configured, and

- The BW of the CSI-RS on the intra-frequency neighbor cell is within the active BWP of the UE, and

- The associated SSB of the CSI-RS resources being identified or measured are detectable, and the CSI-RS resources configured for CSI-RS based L3 measurements are measurable, and

- The bandwidth of CSI-RS resources of intra-MO is the same as that of the CSI-RS resources configured for the serving cell, and

- All CSI-RS resources on one intra-frequency layer are configured within up to two separate windows where each window is up to 5 ms, and

- for the case of single window further provided

- The periodicity of the configured CSI-RS resources is 10 ms, 20 ms or 40 ms

- for the case of two separate windows further provided

- The two windows are either both fully non-overlapped with MG or both partially overlapped with MG

- The periodicity of the configured CSI-RS resources is 20 ms or 40 ms

- The starting point of the first window is the slot boundary of the serving cell, where the corresponding slot contains the configured L3 CSI-RS resource of the serving cell in the servingCellMO with the smallest offset, and

- The starting point of the second window if configured is determined by an offset of half of the CSI-RS periodicity in slots with regards to the starting point of the first window, and

- Numerology for intra-frequency CSI-RS and data of serving cell are the same.

An intra-frequency cell shall be considered detectable when for each relevant associated SSB:

- SS-RSRP related side conditions given in clauses 10.1.2.1 for FR1, for a corresponding band,

- SS-RSRQ related side conditions given in clauses 10.1.7.1 for FR1, for a corresponding band,

- SS-SINR related side conditions given in clauses 10.1.12.1 for FR1, for a corresponding band,

- SSB\_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding band.

A CSI-RS resource shall be considered measurable when for each relevant CSI-RS resource:

- CSI-RSRP related side conditions given in clauses 10.1.2.3 for FR1, for a corresponding band,

- CSI-RSRQ related side conditions given in clauses 10.1.7.2 for FR1, for a corresponding band,

- CSI-SINR related side conditions given in clauses 10.1.12.2 for FR1, for a corresponding band,

- CSI\_RP and CSI-RS Ês/Iot according to Annex B.2.12 for a corresponding band.

#### 9.10D.2.3 Number of cells and number of CSI-RS

##### 9.10D.2.3.1 Requirements for FR1

For each intra-frequency CSI-RS layer, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 32 CSI-RSs with different CSI-RS index and/or PCI on the intra-frequency layer, and

- the cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer of the associated SSB

#### 9.10D.2.4 Measurement Reporting Requirements

Note: The UE is not required to report CSI-RS based L3 measurements when the timing offset between the reference measurement timing and the target CSI-RS in one layer is larger than one CP. If the UE reports CSI-RS based L3 measurements when the timing offset exceeds one CP, the UE may not meet the CSI-RS based L3 measurement accuracy requirements for CSI-RSRP, CSI-RSRQ and CSI-SINR in TS 38.133 [2] clause 10.1, which apply only when the timing offset is no larger than one CP.

##### 9.10D.2.4.1 Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses 10.1.2.3, 10.1.7.2, and 10.1.12.2.

##### 9.10D.2.4.2 Event-triggered Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.1.2.3, 10.1.7.2, and 10.1.12.2.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.10D.2.4.3.

##### 9.10D.2.4.3 Event Triggered Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI- SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.2.3, 10.1.7.2, and 10.1.12.2.

The UE shall not send any event triggered measurement reports as long as no reporting criterion is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than the CSI-RS based measurement defined in clause 9.10D.2.5. When L3 filtering is used an additional delay can be expected.

#### 9.10D.2.5 Intra-frequency measurements without measurement gaps

If a UE is configured with the higher layer parameters *CSI-RS-Resource-Mobility* and *associatedSSB*, the CSI-RS based measurement shall include PSS/SSS detection time of associatedSSB, the time period used to acquire the SFN information and CSI-RS based measurement period without gap.

- PSS/SSS detection time of associatedSSB is the intra-frequency TPSS/SSS\_sync\_intra in clause 9.2D.5.1.

- The time period used to acquire the SFN information is equal to 0 if the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise, the time period used to acquire the SFN information is TCSI-RS\_SFN\_intra as shown in table 9.10D.2.5-3 for FR1.

- If the associatedSSB, which has been detectable at least for the time period Tidentify\_intra\_with\_index defined in clause 9.2D.5.1, becomes undetectable for a period ≤ 5 seconds and then the associatedSSB becomes detectable again with the same spatial reception parameter provided the timing to that cell has not changed more than  3200/ Tc, where *µ* is the SCS configuration as defined in clause 4.2 of TS 38.211 [3], PSS/SSS detection time and time period used to acquire the SFN information are equal to 0.

The measurement period for CSI- RS based intra-frequency measurements without gaps is as shown in table 9.10D.2.5-1.

Additionally, for a given CSI-RS resource, if the associated SS/PBCH block is configured but not detected by the UE, or if CSI-RS is configured with associated SSB but not QCL-ed to the associated SSB, the UE is not required to monitor the corresponding CSI-RS resource.

Table 9.10D.2.5-1: Measurement period for intra-frequency CSI-RS based measurements without gaps(FR1)

|  |  |
| --- | --- |
| DRX cycle | T CSI-RS\_measurement\_period\_intra |
| No DRX | max(200 ms, ceil( 5 x Kp\_CSI-RS x N1Note 3 x Klayer1\_measurement ) x CSI-RS period) x CSSFintra |
| DRX cycle≤ 320 ms | max(200 ms, ceil(1.5x 5 x Kp\_CSI-RS x N1Note 3 x Klayer1\_measurement ) x max(CSI-RS period, DRX cycle)) x CSSFintra |
| DRX cycle>320 ms | ceil( 5 x Kp\_CSI-RS x N1Note 3 x Klayer1\_measurement ) x DRX cycle x CSSFintra |
| NOTE 1: The requirements apply assuming CSI-RS configuration with {D=3 with PRBs ≥ 48}. D is frequency domain density for the 1-port CSI-RS for L3 mobility defined in clause 7.4.1 of TS 38.211 [6].  NOTE 2: Kp\_CSI-RS is applicable for a UE supporting concurrent gaps  NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1. | |

CSSFintra: it is a carrier specific scaling factor and is determined according to CSSFoutside\_gap,i in clause 9.1D.5.

For a UE not supporting *concurrentMeasGap-r17* or for a UE is supporting *concurrentMeasGap-r17* but not configured with concurrent measurement gaps,

- if the intra-frequency CSI-RS resource does not overlap with any measurement gaps, Kp\_CSI-RS=1;

- if some occasions of the intra-frequency CSI-RS resource is overlapped with measurement gaps, Kp\_CSI-RS = 1/(1- (CSI-RS resource period /MGRP)) , where CSI-RS resource period < MGRP, and the MGRP is the periodicity of the measurement gap.

- Otherwise, when UE supports concurrent measurement gaps*,* and concurrent measurement gaps are configured, Kp\_CSI-RS is the scaling factor for a CSI-RS frequency layer to be measured outside gap which is defined as Kp\_CSI-RS = Ntotal / Navailable

For a window W of duration max(CSI-RS period, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE MG, and starting at the beginning of any gap occasions covering the CSI-RS resources:

Ntotal is the total number of CSI-RS resources within the window, including those overlapped with other MG occasions within the window, and

Navailable is the number of CSI-RS resources that are not overlapped with any other non-dropped MG occasion within the window W, after accounting for MG collisions by applying the selected gap collision rule.

Kp\_CSI-RS = 1 when Navailable = 0

For UE supporting [*antennaArrayType-r18*]on the measured carrier,

Klayer1\_measurement=1,

If inter-band carrier aggregation within FR1 is configured [and UE doesn’t support capability of case 4]

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap are not fully overlapped by intra-frequency SMTC occasions of same serving cell

- Otherwise,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap are not fully overlapped by intra-frequency SMTC occasions

Klayer1\_measurement=1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

For UE not supporting *antennaArrayType-r18*, Klayer1\_measurement=1.

Table 9.10D.2.5-2: Void

Table 9.10D.2.5-3: Time period for SFN acquisition for intra-frequency CSI-RS based measurements without gaps(FR1)

|  |  |
| --- | --- |
| DRX cycle | TCSI-RS\_SFN\_intra |
| No DRX | max(200 ms, ceil(5 x Kp\_CSI-RS x N1Note 2 x Klayer1\_measurement )x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320 ms | max(2000 ms, ceil (1.5 x 5 x Kp\_CSI-RS x N1Note 2 x Klayer1\_measurement ) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320 ms | Ceil(5 x Kp\_CSI-RS x N1Note 2 x Klayer1\_measurement ) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1. | |

When intra-band carrier aggregation is performed, and if ATG UE is indicated by *[skippingSCCneighbourCellMeas]*, N1 =1 and Klayer1\_measurement =1 for the SCC measurement.

#### 9.10D.2.6 Scheduling availability of UE during CSI-RS based intra-frequency measurements

UE is required to be capable of measuring without measurement gaps when CSI-RS resources are completely contained in the active BWP of the UE. Note the configured CSI-RS symbol is indicated in *firstOFDMSymbolInTimeDomain* included in *CSI-RS-ResourceConfigMobility* for RRM. When UE is required to perform CSI-RS based RRM measurements, and any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note same numerology for intra-frequency CSI-RS and data of serving cell is considered in this release.

When intra-band carrier aggregation is performed, and if ATG UE is indicated by *[skippingSCCneighbourCellMeas]*, scheduling availability defined in clause 9.10D.2.6 shall not apply for ATG UE.

##### 9.10D.2.6.1 Scheduling availability of UE performing CSI-RS based measurements in TDD bands

When ATG UE performs CSI-RS intra-frequency measurements in a TDD band,

- The UE is not expected to transmit PUCCH/PUSCH/SRS on configured CSI-RS resource symbols, and on 1 OFDM symbol before and after each consecutively configured CSI-RS symbols.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols. When the ATG UE capable of *antennaArrayType-r18* performs intra-frequency neighbouring cell measurements in a TDD band,

- The UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on configured CSI-RS resource symbols, and on 1 OFDM symbol before and after each consecutively configured CSI-RS symbols.

When intra-band carrier aggregation is performed and the ATG UE is capable of *antennaArrayType-r18,* the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When inter-band carrier aggregation is performed and the ATG UE is capable of *antennaArrayType-r18*, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this band pair.

### 9.10D.3 CSI-RS based Inter-frequency measurements

#### 9.10D.3.1 Introduction

A measurement is defined as a CSI-RS based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.10D.2.

If a UE is configured with the higher layer parameter *CSI-RS-Resource-Mobility* and the higher layer parameter *associatedSSB* is configured, the UE shall be able to identify inter-frequency cells indicated for measurement and perform CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements of identified inter-frequency cells.

When measurement gaps are needed, the UE is not expected to detect the associated SSB nor perform measurement of the CSI-RS resource configured in *CSI-RS-Resource-Mobility* on an inter-frequency measurement object which start earlier than the gap starting time + switching time, and ends later than the gap end – switching time. The switching time is 0.5 ms.

#### 9.10D.3.2 Requirements applicability

The associated SSB layer of the CSI-RS follows the same requirements as SSB based measurements defined in clause 9.3D.

The requirements in clause 9.10D.3 apply, provided:

- The associated SSB of the cell being identified or measured is detectable, and

- All CSI-RS resources on one inter-frequency layer are configured within a window of up to 5 ms, and

- The periodicity of the configured CSI-RS resources is 10 ms, 20 ms or 40 ms, and

- CSI-RS resources for measurements and the associated SSB for cell identification are configured within measurement gap.

An inter-frequency cell shall be considered detectable when for each relevant associated SSB:

- SS-RSRP related side conditions given in clauses 10.1.4.1 for FR1, for a corresponding band,

- SS-RSRQ related side conditions given in clauses 10.1.9.1 for FR1, for a corresponding band,

- SS-SINR related side conditions given in clauses 10.1.14.1 for FR1, for a corresponding band,

- SSB\_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding band.

A CSI-RS resource shall be considered measurable when for each relevant CSI-RS resource:

- CSI-RSRP related side conditions given in clauses 10.1.4.3 for FR1, for a corresponding band,

- CSI-RSRQ related side conditions given in clauses 10.1.9.2 for FR1, for a corresponding band,

- CSI-SINR related side conditions given in clauses 10.1.14.2 for FR1, for a corresponding band,

- CSI \_RP and CSI-RS Ês/Iot according to Annex B.2.13 for a corresponding band.

#### 9.10D.3.3 Number of cells and number of CSI-RS resources

##### 9.10D.3.3.1 Requirements for FR1

For each inter-frequency CSI-RS layer, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 14 CSI-RSs with different CSI-RS index and/or PCI , and

- The cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer of the associated SSB.

#### 9.10D.3.4 Measurements reporting requirements

NOTE: The UE is not required to report CSI-RS based L3 measurements when the timing offset between the reference measurement timing and the target CSI-RS in one layer is larger than one CP. If the UE reports CSI-RS based L3 measurements when the timing offset exceeds one CP, the UE may not meet the CSI-RS based L3 measurement accuracy requirements for CSI-RSRP, CSI-RSRQ and CSI-SINR in TS 38.133 [2] clause 10.1, which apply only when the timing offset is no larger than one CP.

##### 9.10D.3.4.1 Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4.3, 10.1.9.2 and 10.1.14.2.

##### 9.10D.3.4.2 Event-triggered Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4.3, 10.1.9.2, and 10.1.14.2.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.10D.3.4.3.

##### 9.10D.3.4.3 Event-triggered Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4.3, 10.1.9.2 and 10.1.14.2.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 × TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within CSI-RS based measurement defined in clause.When L3 filtering is used an additional delay can be expected.

#### 9.10D.3.5 Inter-frequency measurements with measurement gaps

When measurement gaps are provided, if configured with the higher layer parameters *CSI-RS-Resource-Mobility* and *associatedSSB,* the UE shall be able to identify a new detectable CSI-RS based inter-frequency cell within T CSI-RS\_identify\_inter,

T CSI-RS\_identify\_inter = (TPSS/SSS\_sync + T CSI-RS\_measurement\_period\_inter + TCSI-RS\_SFN\_inter) ms

Where:

TPSS/SSS\_sync is the time period used in PSS/SSS detection which is determined according to TPSS/SSS\_sync\_inter in clause9.3D.4,

TCSI-RS\_SFN\_inter is the time period used to acquire the SFN information of the cell being measured, which is shown in table 9.10D.3.5-3 for FR1,

TCSI-RS\_measurement\_period\_inter: equal to a measurement period of CSI-RS based measurement given in table 9.10D.3.5-1.

CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap,i in clause 9.1D.5 for measurement conducted within measurement gaps.

If a UE which supports concurrent measurement gaps has been configured with concurrent measurement gaps, Kp\_CSI-RS is the scaling factor for a CSI-RS frequency layer to be measured within the associated measurement gap which is defined as Kp\_CSI-RS = Ntotal / Navailable. Kp\_CSI-RS = 1 for for UE not configured with concurrent measurement gaps.

- For a window W of duration max(CSI-RS period, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE MG and per-FR1 MG within the same FR as the CSI-RS frequency layer, and starting at the beginning of any gap occasions covering the CSI-RS resources.:

- Ntotal is the total number of associated gap occasions covering CSI-RS resources within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and

- Navailable is the number of non-dropped associated gap occasions covering CSI-RS resources within the window W, after accounting for MG collisions by applying the selected gap collision rule.

- Requirements do not apply if Navailable = 0

For UE supporting [*antennaArrayType-r18*] on the measured carrier,

Klayer1\_measurement=1,

If inter-band carrier aggregation within FR1 is configured [and UE doesn’t support capability of case 4]

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap are not fully overlapped by intra-frequency SMTC occasions of same serving cell

Otherwise,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap are not fully overlapped by intra-frequency SMTC occasions

Klayer1\_measurement=1.5, otherwise.

For UE not supporting *antennaArrayType-r18*, Klayer1\_measurement=1.

Additionally, for a given CSI-RS resource, if the associated SSB is configured but not detected by the UE, or if CSI-RS configured with associated SSB but not QCL-ed to the associated SSB, the UE is not required to monitor the corresponding CSI-RS resource.

Table 9.10D.3.5-1: Measurement period for CSI-RS based inter-frequency measurements with gaps (FR1)

|  |  |
| --- | --- |
| Condition NOTE1 | T CSI-RS\_measurement\_period\_inter |
| No DRX | Max(200 ms, ceil(8 × Kp\_CSI-RS x N1Note 3 x Klayer1\_measurement ) × Max(MGRP, CSI-RS period)) × CSSFinter |
| DRX cycle ≤ 320 ms | Max(200 ms, Ceil(8 × 1.5 × Kp\_CSI-RS x N1Note 3 x Klayer1\_measurement )) × Max(MGRP, CSI-RS period, DRX cycle)) × CSSFinter |
| DRX cycle > 320 ms | Ceil(8 × Kp\_CSI-RS x N1Note 3 x Klayer1\_measurement ) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: Kp\_CSI-RS is applicable for a UE supporting concurrent gaps  NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1. | |

Table 9.10D.3.5-2: Void

Table 9.10D.3.5-3: Time period for SFN acquisition for inter-frequency CSI-RS based measurements with gaps(FR1)

|  |  |
| --- | --- |
| Condition NOTE1 | T CSI-RS\_SFN\_inter |
| No DRX | Max(200 ms, ceil(5 × Kp\_CSI-RS x N1Note 3 x Klayer1\_measurement )× Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320 ms | Max(200 ms, Ceil(5 × 1.5 × Kp\_CSI-RS x N1Note 3 x Klayer1\_measurement ) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320 ms | Ceil(5 × Kp\_CSI-RS x N1Note 3 x Klayer1\_measurement )× DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: Kp\_CSI-RS is applicable for a UE supporting concurrent gaps  NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1. | |

When intra-band carrier aggregation is performed, and if ATG UE is indicated by *[skippingSCCneighbourCellMeas]*, N1 =1 and Klayer1\_measurement =1 for the SCC measurement

**<End of change#25>**

**<Start of change#26>**

## B.3.2 Receiver sensitivity relaxation for CA

### B.3.2.1 Receiver sensitivity relaxation for UE supporting CA in FR1

For a UE supporting inter-band carrier aggregation configuration with uplink in NR band, if there is a relaxation of receiver sensitivity ΔRIB,c>0 dB as defined in clause 7.3A.3 of TS 38.101-1 [18], the relevant side conditions specifying received power levels (SSB\_RP and Io) shall be increased by the amount Δ=ΔRIB,c defined for the corresponding downlink NR bands.

For a ATG UE supporting inter-band carrier aggregation configuration with uplink in NR band, if there is a relaxation of receiver sensitivity ΔRIB,c>0 dB as defined in clause [7.3J.x] of TS 38.101-1 [18], the relevant side conditions specifying received power levels (SSB\_RP and Io) shall be increased by the amount Δ=ΔRIB,c defined for the corresponding downlink NR bands.

For a UE supporting CA configuration in FR1, the requirement in this clause applies for both SC and CA operation.

### B.3.2.2 Receiver sensitivity relaxation for UE configured with CA in FR1

#### B.3.2.2.1 Inter-band carrier aggregation

For a UE configured with inter-band carrier aggregation with active uplink in NR band, if there is a relaxation of receiver sensitivity ΔRIB,c>0 dB as defined in clause 7.3A.3 of TS 38.101-1 [18], the relevant side conditions specifying received power levels (SSB\_RP and Io) shall be increased by the amount Δ=ΔRIB,c defined for the corresponding downlink NR bands.

For a ATG UE configured with inter-band carrier aggregation with active uplink in NR band, if there is a relaxation of receiver sensitivity ΔRIB,c>0 dB as defined in clause [7.3J.x] of TS 38.101-1 [18], the relevant side conditions specifying received power levels (SSB\_RP and Io) shall be increased by the amount Δ=ΔRIB,c defined for the corresponding downlink NR bands.

If the relaxation Δ specified in this clause applies, then the relaxation specified in clause B.3.2.1 should not be applied.

**<End of change#26>**