**3GPP TSG-RAN4 Meeting #109  *R4-2321637***

Chicago, US, November 13th – 17th, 2023

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** | **3907** | **rev** | **1** | **Current version:** | **18.3.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
|  | | | | | | | | |

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

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Big CR to TS 38.133 on Further enhancements on NR and MR-DC measurement gaps and measurements without gaps | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | MediaTek inc., Intel Corporation | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_MG\_enh2-Core | | | | |  | ***Date:*** | | | 03 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduce core requirements for NR\_MG\_enh2-Core | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | **In R18, firstly, R4-2318495 (scheduling restriction) need to be implemented; Second, R4-2320325 (structure reform), and finally apply big CR for R18.**  The changes are based on the following endorsed CRs:   |  |  |  | | --- | --- | --- | | **CR** | **Title** | **Company name** | | R4-2320921 | Draft CR for new abbreviation in 38.133 | MediaTek | | R4-2317291  R4-2319474 | CSSF for R18 MGE (Part1) | OPPO | | R4-2317394  R4-2321571 | Measurement delay for nogap-noncsg EUTRAN FDD | ZTE | | R4-2317292 | Measurement requirements for case 1 and case 2 (Pre-MG/NCSG with concurrent gaps) | CATT | | R4-2317293 | Activation deactivation delay for Pre-MG | vivo | | R4-2317294  R4-2321518 | PreMG and ConMGs | Ericsson | | R4-2317295 | L1 measurement impact for concurrent MG enhancements (Case 1 and Case 2) | Nokia, Nokia Shanghai Bell | | R4-2317296  R4-2321574 | NCSG with concurrent gaps | MediaTek inc. | | R4-2317297  R4-2319477 | CSSF for R18 measurement without gap (Part2) | OPPO | | R4-2317298  R4-2321603 | intra-frequency measurement delay for NFG | CMCC | | R4-2317299  R4-2321565 | interruption requirements for UE reporting NFG | Intel Corporation | | R4-2317301  R4-2321566 | inter-frequency measurement wihtout gap | Qualcomm Incorporated | | R4-2317429  R4-2321570 | measurement delay for nogap-noncsg | Apple | | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | There will be incomplete further enhancement on measurement gaps specifications in TS 38.133. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | **In R18, firstly, R4-2318495 (scheduling restriction) need to be implemented; Second, R4-2320325 (structure reform), and finally apply big CR for R18.**  • 3.3  • 8.1.2.2, 8.1.3.2, 8.1A.2.2,  • 8.2.2.2.X  • 8.5.2.2, 8.5.3.2, 8.5.5.2, 8.5.6.2, 8.5A.2.2, 8.5A.5.2  • 8.19.x    • 9.1.x, 9.1.x.1, 9.1.x.2, 9.1.x.3  • 9.1.y  • 9.1.5  • 9.2.1, 9.2.5, 9.2.5.1, 9.2.5.2, 9.2.5.3  • 9.2.5, 9.2.6, 9.2.7, 9.3.4, 9.3.5, 9.3.9, 9.3.10, 9.4.2, 9.4.3  • 9.3.1, 9.3.9.1, 9.3.9.2  • 9.4.v.3  • 9.4.v  • 9.5.4.1, 9.5.4.2, 9.5A.4, 9.8.4.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 0: 3.3 [R4-2320921] ------------------------**

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [11] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [11].

**1 Rx RedCap**: RedCap UE for which requirements are derived assuming 1 Rx branch.

**2 Rx RedCap**: RedCap UE for which requirements are derived assuming 2 Rx branches.

**Active DL BWP**: Active DL bandwidth part as defined in TS 38.213 [3].

**Blackbox Approach:** Testing methodology, in which the UE internal implementation of certain specific UE functionality involved in the test, is unknown.

**CD-SSB:** Cell defining SSB as defined in TS 38.300 [10].

**Control Resource Set:** As defined in TS 38.213 [3].

**DL BWP**: DL bandwidth part as defined in TS 38.213 [3].

**EN-DC**: E-UTRA-NR Dual Connectivity as defined in clause 4.1.2 of TS 37.340 [17].

**en-gNB**: As defined in TS 37.340 [17].

**FR1**: Frequency range 1 as defined in clause 5.1 of TS 38.104 [13].

**FR2**: Frequency range 2 as defined in clause 5.1 of TS 38.104 [13].

**gNB**: as defined in TS 38.300 [10].

**IBM (Independent Beam Management):** As defined in TS 38.101-2 [19].

**IDC solution:** As described in TS 36.300 [24] and TS 38.300 [10].

**LMF**: as defined in TS 38.305 [22].

**Master Cell Group:** As defined in TS 38.331 [2].

**Multi-Radio Dual Connectivity:** Dual Connectivity between E-UTRA and NR nodes, or between two NR nodes, as defined in TS 37.340 [17].

**NCD-SSB:** Non cell defining SSB as defined in TS 38.300 [10].

**ng-eNB**: As defined in TS 38.300 [10].

**NE-DC**: NR-E-UTRA Dual Connectivity as defined in clause 4.1.3.2 of TS 37.340 [17].

**NGEN-DC**: NG-RAN E-UTRA-NR Dual Connectivity as defined in clause 4.1.3.1 of TS 37.340 [17].

**NR-DC**: NR-NR Dual Connectivity as defined in clause 4.1.3.3 of TS 37.340 [17].

**Primary Cell**: As defined in TS 38.331 [2].

**PRS resource instance:** An instance in time of a configured PRS resource as defined in TS 38.331 [2], which may or not overlap with a measurement gap occasion.

**Quasi Co-Location:** As defined in TS 38.214 [26].

**RedCap UE:** A UE with reduced capabilities as defined in clause 4.2 in TS 38.306 [14].

**RLM-RS resource:** A resource out of the set of resources configured for RLM by higher layer parameter RLM-RS-List [2] as defined in TS 38.213 [3].

**SA operation mode**: Operation mode when the UE is configured with at least PCell and not any MR-DC.

**Secondary Cell**: As defined in TS 38.331 [2].

**Secondary Cell Group:** As defined in TS 38.331 [2].

**Serving Cell**: As defined in TS 38.331 [2].

**SMTC**: An SSB-based measurement timing configuration configured by *SSB-MeasurementTimingConfiguration* as specified in TS 38.331 [2].

**Special Cell:** As defined in TS 38.331 [2].

**SSB:** SS/PBCH block as defined in clause 7.8.3 of TS 38.211 [6].

**Timing Advance Group**: As defined in TS 38.331 [2].

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

BWChannel Channel bandwidth, defined in TS 38.101-1, 38.101-2 and 38.101-3 subclause 3.2

Ês Received energy per RE (power normalized to the subcarrier spacing) during the useful part of the symbol, i.e. excluding the cyclic prefix, at the UE antenna connector or radiated interface boundary

FC *RF reference frequency* on the channel raster, given in table 5.4.2.2-1 in TS 38.101-1 and 38.101-2

FC,low The Fc of the lowest carrier, expressed in MHz

Io The total received power density, including signal and interference, as measured at the UE antenna connector or radiated interface boundary.

Ioc The power spectral density (integrated in a noise bandwidth equal to the chip rate and normalized to the chip rate) of a band limited noise source (simulating interference from cells, which are not defined in a test procedure) as measured at the UE antenna connector or radiated interface boundary.

Iot The received power spectral density of the total noise and interference for a certain RE (power integrated over the RE and normalized to the subcarrier spacing) as measured at the UE antenna connector or radiated interface boundary

 The power spectral density of a white noise source (average power per RE normalised to the subcarrier spacing), simulating interference from cells that are not defined in a test procedure, as measured at the UE antenna connector or radiated interface boundary

 Physical Resource Block number as defined in clause 3.2 in TS 38.211.

 Timing offset between uplink and downlink radio frames at the UE, as defined in clause 4.2 in TS 38.213.

 Fixed timing advance offset, as defined in clause 7.1.2 in TS 38.133.

   Configured UE transmitted power as defined in clause 6.2.4 in TS 38.101-1, 38-101-2 and 38.101-3.

PCMAX,c Configured UE transmitted power on a serving cell *c* as defined in clause 6.2.4 in TS 38.101-1, 38-101-2 and 38.101-3

S Cell Selection Criterion defined in TS 38.304, subclause 5.2.3.2 for NR

SSB\_RP Received (linear) average power of the resource elements that carry NR synchronisation burst, measured at the UE antenna connector or radiated interface boundary

Srxlev Cell selection RX level, defined in TS 38.304, subclause 5.2.3.2

Squal Cell selection quality, defined in TS 38.304, subclause 5.2.3.2

Sintrasearch Defined in TS 38.304 , subclause 5.2.4.7 for E-UTRAN amd 38.304 subclause 5.2.4.7 for NR

Snonintrasearch Defined in TS 38.304 , subclause 5.2.4.7

Threshx, high Defined in TS 38.304 , subclause 5.2.4.7

Threshx, low Defined in TS 38.304 , subclause 5.2.4.7

Threshserving, low Defined in TS 38.304 , subclause 5.2.4.7

TRE-ESTABLISH-REQ The RRC Re-establishment delay requirement, the time between the moment when erroneous CRCs are applied, to when the UE starts to send preambles on the PRACH.

Tc Basic time unit, defined in clause 4.1 of TS 38.211 [6].

Ts Reference time unit, defined in clause 4.1 of TS 38.211 [6].

Treselection Defined in TS 25.304, subclause 5.2.6.1.5

TreselectionRAT Defined in TS 36.304 , subclause 5.2.4.7

TreselectionEUTRA Defined in TS 36.304 , subclause 5.2.4.7

TreselectionUTRA Defined in TS 36.304 , subclause 5.2.4.7

TreselectionGERANDefined in TS 36.304 , subclause 5.2.4.

Threshx, high Defined in TS 38.304 , subclause 5.2.4.7

Threshx, low Defined in TS 38.304 , subclause 5.2.4.7

Threshserving, low Defined in TS 38.304 , subclause 5.2.4.7

TUE\_re-establish\_delay Time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell.

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [11] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [11].

AoA Angle of Arrival

AoD Angle of Departure

ATG Air to Ground

BFD Beam Failure Detection

BFD-RS BFD Reference Signal

BLER Block Error Rate

BM-RS Beam Management Reference Signal

BWP Bandwidth Part

CA Carrier Aggregation

CBD Candidate Beam Detection

CBW Channel Bandwidth

CC Component Carrier

CCA Clear Channel Assessment

CG-SDT Configured Grant Small Data Transmisison

CLI Cross Link Interference

CMR Channel Measurement Resource

CORESET Control Resource Set

CP Cyclic Prefix

CSI Channel-State Information

CSI-RS CSI Reference Signal

CSI-RSRP CSI Reference Signal based Reference Signal Received Power

CSI-RSRQ CSI Reference Signal based Reference Signal Received Quality

CSI-SINR CSI Reference Signal based Signal to Noise and Interference Ratio

CSI\_RP Received (linear) average power of the resource elements that carry NR CSI-RS signals and channels, measured at the UE antenna connector

DBT Discovery Burst Transmission

DC Dual Connectivity

DCI Downlink Control Information

DL Downlink

DL-AoD Downlink Angle-of-Departure

DL-TDOA Downlink Time Difference Of Arrival

DMRS Demodulation Reference Signal

DRX Discontinuous Reception

E-CID Enhanced Cell ID

E-UTRA Evolved UTRA

E-UTRAN Evolved UTRAN

EMW Effective measurement window

EMWRP Effective measurement window repetition period

EN-DC E-UTRA-NR Dual Connectivity

FDD Frequency Division Duplex

FR Frequency Range

GEO Geostationary Earth Orbit

HARQ Hybrid Automatic Repeat Request

HO Handover

GAP Refers to any of Measurement Gap, activated Pre-MG and NCSG

IMR Interference Measurement Resource

L1-RSRP Layer 1 RSRP

L1 SL-RSRP Layer 1 Sidelink RSRP which corresponds to PSCCH-RSRP and/or PSSCH-RSRP

LEO Low Earth Orbit

LMF Location Management Function

LPP LTE Positioning Protocol

MAC Medium Access Control

MCG Master Cell Group

MDT Minimization of Drive Tests

MG Measurement Gap

MGL Measurement Gap Length

MGRP Measurement Gap Repetition Period

MIB Master Information Block

ML Measurement Length

MN Master Node

MR-DC Multi-Radio Dual Connectivity

MUSIM Multi-Universal Subscriber Identity Module

NCSG Network Controlled Small Gap

NE-DC NR-E-UTRA Dual Connectivity

NGEN-DC NG-RAN E-UTRA-NR Dual Connectivity

NR New Radio

NR-DC NR-NR Dual Connectivity

NTN Non-Terrestrial Network

OFDM Orthogonal Frequency Division Multiplexing

OFDMA Orthogonal Frequency Division Multiple Access

OTDOA Observed Time Difference Of Arrival

PBCH Physical Broadcast Channel

PCC Primary Component Carrier

PCell Primary Cell

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PLMN Public Land Mobile Network

PRACH Physical RACH

Pre-MG Pre-configured Measurement Gap

PRP PRS Received Power

PRS Positioning Reference Signal

PRS-RSRP Positioning Reference Signal based Reference Signal Received Power

PPW PRS Processing Window

PSBCH Physical Sidelink Broadcast Channel

PSBCH-RSRP Physical Sidelink Broadcast Channel DMRS based Reference Signal Received Power

PSCCH Physical Sidelink Control Channel

PSCCH-RSRP Physical Sidelink Control Channel DMRS based Reference Signal Received Power

PSCell Primary SCell

PSS Primary Synchronization Signal

PSSCH Physical Sidelink Shared Channel

PSSCH-RSRP Physical Sidelink Shared Channel DMRS based Reference Signal Received Power

pTAG Primary Timing Advance Group

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

QCL Quasi Co-Location

RACH Random Access Channel

RAT Radio Access Technology

RLM Radio Link Monitoring

RLM-RS Reference Signal for RLM

RMSI Remaining Minimum System Information

RRC Radio Resource Control

RRH Remote Radio Head

RRM Radio Resource Management

RSSI Received Signal Strength Indicator

RSRP Reference Signal Received Power

RSRQ Reference Signal Received Quality

RSTD Reference Signal Time Difference

RTT Round Trip Time

S-SSB Sidelink Synchronization Signal Block

SSB\_RP Received (linear) average power of the resource elements that carry NR SSB signals and channels, measured at the UE antenna connector or radiated interface boundary.

SA Standalone operation mode

SAB Satellite access band

SAN Satellite Access Node

SCC Secondary Component Carrier

SCell Secondary Cell

SCG Secondary Cell Group

SCS Subcarrier Spacing

SCSSSB SSB subcarrier spacing

SDL Supplementary Downlink

SDT Small Data Transmission

SFN System Frame Number

SFTD SFN and Frame Timing DifferenceSI System Information

SIB System Information Block

SL-RSSI Sidelink Received Signal Strength Indicator

SLSS Sidelink Synchronization Signal

SMTC SSB-based Measurement Timing configuration

SpCell Special Cell

SRS Sounding Reference Signal

SRS-RSRP Sounding Reference Signal based Reference Signal Received Power

SS-RSRP Synchronization Signal based Reference Signal Received Power

SS-RSRQ Synchronization Signal based Reference Signal Received Quality

SS-SINR Synchronization Signal based Signal to Noise and Interference Ratio

SSB Synchronization Signal Block

SSB\_RP Received (linear) average power of the resource elements that carry NR SSB signals and channels, measured at the UE antenna connector.

SSS Secondary Synchronization Signal

sTAG Secondary Timing Advance Group

SUL Supplementary Uplink

TA Timing Advance

TAG Timing Advance Group

TCI Transmission Configuration Indicator

TDD Time Division Duplex

TDOA Time Difference Of Arrival

TN Terrestrial Network

TRP Transmission-Reception Point

TTI Transmission Time Interval

UE User Equipment

UL Uplink

VIL Visible Interruption Length

VIRP Visible Interruption Repetition Period

VSAT Very Small Aperture Terminal

**---------------END OF CHANGES 0: 3.3 [R4-2320921] --------------------**

**--------------START OF CHANGE 1: 8.1.2.2 [R4-2317295] ---------------**

### 8.1.2 Requirements for SSB based radio link monitoring

**<unchanged sections omitted>**

#### 8.1.2.2 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 [ms] period becomes worse than the threshold Qout\_SSB within TEvaluate\_out\_SSB [ms] 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 [ms] period becomes better than the threshold Qin\_SSB within TEvaluate\_in\_SSB [ms] evaluation period.

TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in Table 8.1.2.2-1 for FR1.

TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in Table 8.1.2.2-2 for FR2 with scaling factor N=8 for FR2-1 and N=12 for FR2-2, for FR2 power classes other than power class 6 or for FR2 power class 6 when *highSpeedMeasFlagFR2-r17* is not configured

TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in Table 8.1.2.2-3 for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*.

TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in Table 8.1.2.2-4 for FR1 (deactivated PSCell).

TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in Table 8.1.2.2-5 for FR2 (deactivated PSCell) with scaling factor N=8 for FR2-1 and N=12 for FR2-2.

For a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent measurement gaps are configured,

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

- Ntotal / Noutside\_MG in FR1

- Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0

- Ntotal / Navailable in FR2 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 or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any RLM-RS resource occasion:

- Ntotal is the total number of RLM-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 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 within the window W

- TL1 is periodicity of the target RLM-RS.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s),

For FR1,

- , when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, and these GAPs 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.

For FR2

- , when RLM-RS resource is not overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is Psharing factor, when the RLM-RS resource is not overlapped with GAP and RLM-RS resource is fully overlapped with SMTC occasion (TSSB = TSMTCperiod).

- , when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with GAP and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TSSB < 0.5\*TSMTCperiod

- , when the RLM-RS is partially overlapped with GAP and the RLM-RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with GAP and TSMTCperiod = xRP and TSSB = 0.5 × TSMTCperiod

- , when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with GAP

- , when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with GAP (TSMTCperiod < xRP)

where,

- Psharing factor = 1, if the RLM-RS resource outside gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

- If the high layer in TS 38.331 [2] signaling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.* TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

- When a measurement gap is configured only and the measurement gap is not NCSG,

- an RLM-RS resource or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG only, an RLM-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,

- an RLM-RS resource or an SMTC occasion is considered to be overlapped with the GAP if

- it overlaps the VIL1 or VIL2 of NCSG, or

- it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

- and

- xRP = VIRP

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG measurement gap(s) are configured, an RLM-RS resource or an SMTC occasion is not considered as overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

If the high layer in TS 38.331 [2] signaling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.*

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and GAP configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

Table 8.1.2.2-1: Evaluation period TEvaluate\_out\_SSB and TEvaluate\_in\_SSB for FR1

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_SSB (ms) | TEvaluate\_in\_SSB (ms) |
| no DRX | Max(200, Ceil(10 × P) × TSSB) | Max(100, Ceil(5 × P) × TSSB) |
| DRX cycle≤320ms | Max(200, Ceil(15 × P) × Max(TDRX,TSSB)) | Max(100, Ceil(7.5 × P) × Max(TDRX,TSSB)) |
| DRX cycle>320ms | Ceil(10 × P) × TDRX | Ceil(5 × P) × TDRX |
| NOTE: TSSB is the periodicity of the SSB configured for RLM. TDRX is the DRX cycle length. | | |

Table 8.1.2.2-2: Evaluation period TEvaluate\_out\_SSB and TEvaluate\_in\_SSB for FR2

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_SSB (ms) | TEvaluate\_in\_SSB (ms) |
| no DRX | Max(200, Ceil(10 × P × N) × TSSB) | Max(100, Ceil(5 × P × N) × TSSB) |
| DRX cycle≤320ms | Max(200, Ceil(15 × P × N) × Max(TDRX,TSSB)) | Max(100, Ceil(7.5 × P × N) × Max(TDRX,TSSB)) |
| DRX cycle>320ms | Ceil(10 × P × N) × TDRX | Ceil(5 × P × N) × TDRX |
| NOTE: TSSB is the periodicity of the SSB configured for RLM. TDRX is the DRX cycle length. | | |

Table 8.1.2.2-3: Evaluation period TEvaluate\_out\_SSB and TEvaluate\_in\_SSB for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_SSB (ms) | TEvaluate\_in\_SSB (ms) |
| no DRX | Max(200, Ceil(10 × P × N Note2) × TSSB) | Max(100, Ceil(5 × P × N Note2) × TSSB) |
| DRX cycle≤80ms | Max(200, Ceil(15 × P × N Note2) × Max(TDRX,TSSB)) | Max(100, Ceil(7.5 × P × N Note2) × Max(TDRX,TSSB)) |
| NOTE 1: TSSB is the periodicity of the SSB configured for RLM. TDRX is the DRX cycle length.  NOTE 2: For a UE not supporting [*simultaneousReceptionFR2HST-r18*] or when *highSpeedDeploymentTypeFR2-r17* is not configured as *bi-directional*, scaling factor N=2 when *highSpeedMeasFlagFR2-r17* is configured to set1 and scaling factor N=6 when *highSpeedMeasFlagFR2-r17* is configured to set2. For a UE supporting [*simultaneousReceptionFR2HST-r18*] and when *highSpeedDeploymentTypeFR2-r17* is configured as *bidirectional*, scaling factor N=[TBD] when *highSpeedMeasFlagFR2-r17* is configured to set1 and scaling factor N=[4] when *highSpeedMeasFlagFR2-r17* is configured to set2 | | |

Table 8.1.2.2-4: Evaluation period TEvaluate\_out\_SSB and TEvaluate\_in\_SSB for FR1(deactivated PSCell)

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_SSB (ms) | TEvaluate\_in\_SSB (ms) |
| no DRX | Ceil(10 × P) × measCyclePSCell | Ceil(5 × P) × measCyclePSCell |
| DRX cycle≤ 320ms | Ceil(15 × P) × Max(TDRX, measCyclePSCell) | Ceil(7.5 × P) × Max(TDRX, measCyclePSCell) |
| DRX cycle> 320ms | Ceil(10 × P) × Max(TDRX, measCyclePSCell) | Ceil(5 × P) × Max(TDRX, measCyclePSCell) |
| NOTE: TDRX is the DRX cycle length of SCG. measCyclePSCell is the measurement cycle length of the deactivated PSCell. | | |

Table 8.1.2.2-5: Evaluation period TEvaluate\_out\_SSB and TEvaluate\_in\_SSB for FR2(deactivated PSCell)

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_SSB (ms) | TEvaluate\_in\_SSB (ms) |
| no DRX | Ceil(10 × P× N) × measCyclePSCell | Ceil(5 × P× N) × measCyclePSCell |
| DRX cycle≤ 320 ms | Ceil(15 × P× N) × Max(TDRX, measCyclePSCell) | Ceil(7.5 × P× N) × Max(TDRX, measCyclePSCell) |
| DRX cycle> 320 ms | Ceil(10 × P× N) × Max(TDRX, measCyclePSCell) | Ceil(5 × P× N) × Max(TDRX, measCyclePSCell) |
| NOTE: TDRX is the DRX cycle length of SCG. measCyclePSCell is the measurement cycle length of the deactivated PSCell. | | |

**---------------END OF CHANGES 1: 8.1.2.2 [R4-2317295] -------------**

**-------------START OF CHANGE 2: 8.1.3.2 [R4-2317295] -----------------**

### 8.1.3 Requirements for CSI-RS based radio link monitoring

**<unchanged sections omitted>**

#### 8.1.3.2 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 ms period becomes worse than the threshold Qout\_CSI-RS within TEvaluate\_out\_CSI-RS ms 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 ms period becomes better than the threshold Qin\_CSI-RS within TEvaluate\_in\_CSI-RS ms evaluation period.

- TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS are defined in Table 8.1.3.2-1 for FR1.

- TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS are defined in Table 8.1.3.2-2 for FR2 with scaling factor N=1.

- TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS are defined in Table 8.1.3.2-3 for FR1 (deactivated PSCell).

- TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS are defined in Table 8.1.3.2-4 for FR2 (deactivated PSCell) with scaling factor N=1.

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 a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent measurement gaps are configured,

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

- Ntotal / Noutside\_MG in FR1

- Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0

- Ntotal / Navailable in FR2 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 or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any RLM-RS resource occasion:

- Ntotal is the total number of RLM-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 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 within the window W

- TL1 is periodicity of the target RLM-RS.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s),

For FR1,

- , when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, and these GAPs] 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.

For FR2,

- P=1, when the RLM-RS resource is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- , when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is not overlapped with SMTC occasion (TCSI-RS < xRP)

- , when the RLM-RS resource is not overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P = Psharing factor, when the RLM-RS resource is not overlapped with GAP and RLM-RS resource is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- , when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with GAP and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TCSI-RS < 0.5 × TSMTCperiod

- , when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with GAP and TSMTCperiod = xRP and TCSI-RS = 0.5 × TSMTCperiod

- , when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with GAP

- , when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < xRP)

where,

- Psharing factor = 1, if the RLM-RS resource outside gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

- If the high layer in TS 38.331 [2] signaling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.* TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

- When a measurement gap is configured only and the measurement gap is not NCSG,

- an RLM-RS resource or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG only, an RLM-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,

- an RLM-RS resource or an SMTC occasion is considered to be overlapped with the GAP if

- it overlaps the VIL1 or VIL2 of NCSG, or

- it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

- and

- xRP = VIRP

When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG measurement gap(s) are configured , an RLM-RS resource or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

If the high layer in TS 38.331 [2] signaling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.*

Note: The overlap between CSI-RS for RLM and SMTC means that CSI-RS based RLM is within the SMTC window duration.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and GAP configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

The values of Mout and Min used in Table 8.1.3.2-1, Table 8.1.3.2-2, Table 8.1.3.2-3 and Table 8.1.3.2-4 are defined as:

- Mout = 20 and Min = 10, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* [6, clause 7.4.1] set to 3 and over the bandwidth ≥ 24 PRBs.

Table 8.1.3.2-1: Evaluation period TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS for FR1

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_CSI-RS (ms) | TEvaluate\_in\_CSI-RS (ms) |
| no DRX | Max(200, Ceil(Mout×P)×TCSI-RS) | Max(100, Ceil(Min×P) × TCSI-RS) |
| DRX ≤ 320ms | Max(200, Ceil(1.5×Mout×P)× Max(TDRX, TCSI-RS)) | Max(100, Ceil(1.5×Min×P)× Max(TDRX, TCSI-RS)) |
| DRX > 320ms | Ceil(Mout×P) × TDRX | Ceil(Min×P) × TDRX |
| NOTE: TCSI-RS is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for TCSI-RS equal to 5 ms, 10ms, 20 ms or 40 ms. TDRX is the DRX cycle length. | | |

Table 8.1.3.2-2: Evaluation period TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS for FR2

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_CSI-RS (ms) | TEvaluate\_in\_CSI-RS (ms) |
| no DRX | Max(200, Ceil(Mout×P×N)×TCSI-RS) | Max(100, Ceil(Min×P×N) × TCSI-RS) |
| DRX ≤ 320ms | Max(200, Ceil(1.5×Mout×P×N)× Max(TDRX, TCSI-RS)) | Max(100, Ceil(1.5×Min×P×N)× Max(TDRX, TCSI-RS)) |
| DRX > 320ms | Ceil(Mout×P×N) × TDRX | Ceil(Min×P×N) × TDRX |
| NOTE: TCSI-RS is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for TCSI-RS equal to 5 ms, 10 ms, 20 ms or 40 ms. TDRX is the DRX cycle length. | | |

Table 8.1.3.2-3: Evaluation period TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS for FR1 (deactivated PSCell)

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_CSI-RS (ms) | TEvaluate\_in\_CSI-RS (ms) |
| no DRX | Ceil(Mout×P) × measCyclePSCell | Ceil(Min×P) × measCyclePSCell |
| DRX ≤ 320ms | Ceil(1.5 ×Mout×P) × Max(TDRX, measCyclePSCell) | Ceil(1.5 ×Min×P) × Max(TDRX, measCyclePSCell) |
| DRX > 320ms | Ceil(Mout×P) × Max(TDRX, measCyclePSCell) | Ceil(Min×P) × Max(TDRX, measCyclePSCell) |
| NOTE: TDRX is the DRX cycle length of SCG. measCyclePSCell is the measurement cycle length of the deactivated PSCell. | | |

Table 8.1.3.2-4: Evaluation period TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS for FR2 (deactivated PSCell)

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_CSI-RS (ms) | TEvaluate\_in\_CSI-RS (ms) |
| no DRX | Ceil(Mout×P×N) × measCyclePSCell | Ceil(Min×P×N) × measCyclePSCell |
| DRX ≤ 320ms | Ceil(1.5 × Mout×P×N) × Max(TDRX, measCyclePSCell) | Ceil(1.5 × Min×P×N) × Max(TDRX, measCyclePSCell) |
| DRX > 320ms | Ceil(Mout×P×N) × Max(TDRX, measCyclePSCell) | Ceil(Min×P×N) × Max(TDRX, measCyclePSCell) |
| NOTE: TDRX is the DRX cycle length of SCG. measCyclePSCell is the measurement cycle length of the deactivated PSCell. | | |

**---------------END OF CHANGE 2: 8.1.3.2 [R4-2317295] ----------------**

**------------ START OF CHANGE 3: 8.1A.2.2 [R4-2317295] --------------**

## 8.1A Radio Link Monitoring with CCA on Target Frequency

**<unchanged sections omitted>**

### 8.1A.2 Requirements for SSB Based Radio Link Monitoring

**<unchanged sections omitted>**

#### 8.1A.2.2 Minimum Requirement old

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,CCA [ms] period becomes worse than the threshold Qout\_SSB,CCA within TEvaluate\_out\_SSB,CCA [ms] 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,CCA [ms] period becomes better than the threshold Qin\_SSB,CCA within TEvaluate\_in\_SSB,CCA [ms] evaluation period. During the in-sync evaluation procedure, layer 1 of the UE shall not send any in-sync indication for the cell to the higher layers when Lin exceeds Lin,max, where Lin and Lin,max are defined in Table 8.1A.2.2-1.

TEvaluate\_out\_SSB,CCA and TEvaluate\_in\_SSB,CCA are defined in Table 8.1A.2.2-1 for FR1.

TEvaluate\_out\_SSB,CCA and TEvaluate\_in\_SSB,CCA are defined in Table 8.1A.2.2-2 for FR2-2 with scaling factor N = 12.

For a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

- P value for an RLM-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 gap or NCSGs and per-FR measurement gap or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any RLM-RS resource occasion:

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

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s),

For FR1,

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

- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the SSB RLM-RS resources.

When a measurement gap is configured only and the measurement gap is not NCSG,

- an RLM-RS resource is considered to be overlapped with the GAP f it overlaps a measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG only, an RLM-RS resource is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

Otherwise, when NCSG measurement gap only is configured,

- an RLM-RS resource is considered to be overlapped with the GAP if it overlaps the VIL1 or VIL2 of NCSG, and

- xRP = VIRP

When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG measurement gap(s) are configured, an RLM-RS resource is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

For FR2-2,

- , when RLM-RS resource is not overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is Psharing factor, when the RLM-RS resource is not overlapped with measurement gap and RLM-RS resource is fully overlapped with SMTC occasion (TSSB = TSMTCperiod).

- , when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TSSB < 0.5\*TSMTCperiod

- , when the RLM-RS is partially overlapped with measurement gap and the RLM-RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TSSB = 0.5 × TSMTCperiod

- , when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap

- , when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

- Psharing factor = 1, if the RLM-RS resource outside measurement gap is

* not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and K data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and K data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and K is defined in clause 9.2.5.3.3, and,
* not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and K data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and K data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured, and K is defined in clause 9.2.5.3.3.

- Psharing factor = 3, otherwise.

where,

If the high layer in TS 38.331 [2] signaling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.* TSMTCperiod is the shortest SMTC period among all CCs in the same FR2-2 band, provided the SMTC offset of all CCs in FR2-2 have the same offset.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and GAP configurations does not meet previous conditions.

Table 8.1A.2.2-1: Evaluation period TEvaluate\_out\_SSB,CCA and TEvaluate\_in\_SSB,CCA for FR1

|  |  |  |  |
| --- | --- | --- | --- |
| Configuration | TEvaluate\_out\_SSB,CCA (ms) | | TEvaluate\_in\_SSB,CCA (ms) |
|  | RLM-RS SSB Es/IotNote4 ≥-7 dB | RLM-RS SSB Es/Iot Note4 <-7 dB |  |
| no DRX | Max(200, Ceil(17\*P)\*TSSB) | Max(200, Ceil(24\*P)\*TSSB) | Max(100, Ceil((5+Lin)\*P)\*TSSB) |
| DRX cycle≤320 | Max(200, Ceil(1.5\*15\*P)\*Max(TDRX,TSSB)) | Max(200, Ceil(1.5\*20\*P)\*Max(TDRX,TSSB)) | Max(100, Ceil(1.5\*(5+Lin)\*P)\*Max(TDRX,TSSB)) |
| DRX cycle>320 | Ceil(13\*P)\*TDRX | Ceil(16\*P)\*TDRX | Ceil((5+Lin)\*P)\*TDRX |
| NOTE 1: TSSB is the periodicity of the SSB configured for RLM. TDRX is the DRX cycle length.  NOTE 2: When DRX is not configured, Lin is the number of RLM-RS SSB occasions which are not available at the UE during TEvaluate\_in\_SSB,CCA, where Lin ≤ Lin,max. When DRX is configured, Lin is the number of DRX cycles in which at least one RLM-RS SSB occasion is not available at the UE during TEvaluate\_in\_SSB,CCA, where Lin ≤ Lin,max. The UE is not required to determine the availability of SSB occasions more frequent than  Once per Max(10ms, P \* TSSB) if no DRX is used,  Once per Max(10ms, Ceil(1.5 \* P) \* Max(TDRX, TSSB)) if DRX cycle ≤ 320ms,  Once per P \* TDRX if DRX cycle > 320ms.  NOTE 3: Lin,max=7 for Max(TDRX,TSSB) ≤ 40 assuming TDRX=0 for non-DRX case,  Lin,max=5 for 40<Max(TDRX,TSSB)≤320,  Lin,max=3 for TDRX>320.  NOTE 4: RLM-RS SSB Es/Iot is the averaged Es/Iot over the most recent previous out-of-sync evaluation period. | | | |

Table 8.1A.2.2-2: Evaluation period TEvaluate\_out\_SSB,CCA and TEvaluate\_in\_SSB,CCA for FR2-2

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_SSB,CCA (ms) | TEvaluate\_in\_SSB,CCA (ms) |
|  |  |
| no DRX | Max(200, Ceil([12]\*P\* N)\*TSSB) | Max(100, Ceil((5 +Lin)\*P\* N)\*TSSB) |
| DRX cycle≤320 | Max(200, Ceil(1.5\*[10]\*P\* N)\*Max(TDRX,TSSB)) | Max(100, Ceil(1.5\*(5 +Lin)\*P\* N)\*Max(TDRX,TSSB)) |
| DRX cycle>320 | Ceil([10]\*P\* N)\*TDRX | Ceil((5+Lin)\*P\* N)\*TDRX |
| NOTE 1: TSSB is the periodicity of the SSB configured for RLM. TDRX is the DRX cycle length.  NOTE 2: When DRX is not configured, Lin is the number of RLM-RS SSB occasions groups which are not available at the UE during TEvaluate\_in\_SSB,CCA, where Lin ≤ Lin,max. A RLM-RS SSB occasions group consists of N consecutive RLM-RS SSB occasions, and the RLM-RS SSB occasions group is not available at the UE when at least one RLM-SSB occasion in the group is not transmitted by the gNB. When DRX is configured, Lin is the number of DRX cycles groups which are not available at the UE during TEvaluate\_in\_SSB,CCA, where Lin ≤ Lin,max. A DRX group consists of N DRX cycles, and the DRX group is not available when there is at least one DRX in which at least one RLM-RS SSB occasion is not available. The UE is not required to determine the availability of SSB occasions more frequent than once per DRX cycle length, when configured with DRX.  NOTE 3: Lin,max=7 for Max(TDRX,TSSB) ≤ 40 assuming TDRX=0 for non-DRX case,  Lin,max=5 for 40<Max(TDRX,TSSB)≤320,  Lin,max=3 for TDRX>320. | | |

**-------------END OF CHANGE 3: 8.1A.2.2 [R4-2317295] --------------**

**------------ START OF CHANGE 4: 8. 2.2.2.x [R4-2317299] --------------**

##### 8.2.2.2.X Interruptions due to measurements without gap carried out by UE supporting *[NeedForInterruptionInfoNR-R18]*

When a UE supports *[NeedForInterruptionInfoNR-R18]* measurements and indicates *[no-gap-with-interruption]* on intra-frequency SSB-based or inter-frequency SSB-based measurements, the UE is allowed to cause interruptions while performing measurements on the frequency layers of the bands for which *[no-gap-with-interruption]* is indicated. Requirements in this section applies only when the UE is in SA operation mode.

The UE is allowed to cause interruption with interruption ratio no more than the requirements specified below upon UE measurements on a specific frequency layer that corresponds to the configured MO, where Tcycle,i is the measurement cycle on a certain frequency layer i according to the network configuration, specified in sub-clause [TBD].

UE is allowed to cause interruption on a certain frequency layer i:

- up to [2.50%] probability of missed ACK/NACK when 80ms ≤ Tcycle,i < 160ms, or

- up to [1.25%] probability of missed ACK/NACK when 160ms ≤ Tcycle,i < 320ms, or

- up to [0.625%] probability of missed ACK/NACK when 320ms ≤ Tcycle,i.

If measurement gap is configured and the gap occasions are partially or fully overlapped with the SMTC occasions on a certain frequency layer that UE indicates *[no-gap-with-interruption]*, no interruption from measurements on such layer is allowed.

The interruptions are allowed for all the active serving cells in the same FR as NR MO being measured if UE supports per-FR measurement gaps, and all the serving cells if UE does not support per-FR measurement gaps.

Table 8.2.2.2.X-1: Interruption length L in FR1

|  |  |  |  |
| --- | --- | --- | --- |
|  | SCS (kHz) | NR Slot | Interruption length L (slots) |
|  |  | length (ms) |  |
| 0 | 15 | 1 | [1] |
| 1 | 30 | 0.5 | [2] |
| 2 | 60 | 0.25 | [4] |

Table 8.2.2.2.X-2: Interruption length L in FR2

|  |  |  |  |
| --- | --- | --- | --- |
|  | SCS (kHz) | NR Slot | Interruption length L (slots) |
|  |  | length (ms) |  |
| 2 | 60 | 0.25 | [3] |
| 3 | 120 | 0.125 | [6] |

*Editors’ note: Discussion is ongoing on cases where DRX or measurement gap is configured. Further update to this sub-clause subjects to the conclusions of those discussions.*

*Editors’ note2: Definition of Tcycle resembles measurement cycle definition in the measurement period requirements.*

*Editors’ note3: Total interruption ratio requirements will be updated subject to further conclusions.*

**-------------END OF CHANGE 4: 8.2.2.2.x [R4-2317299] --------------**

**------------ START OF CHANGE 5: 8.5.2.2 [R4-2317295] --------------**

8.5 Link Recovery Procedures

**<unchanged sections omitted>**

8.5.2 Requirements for SSB based beam failure detection

**<unchanged sections omitted>**

#### 8.5.2.2 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 ms period becomes worse than the threshold Qout\_LR\_SSB within TEvaluate\_BFD\_SSB ms period.

The value of TEvaluate\_BFD\_SSB is defined in Table 8.5.2.2-1 or Table 8.5.2.2-4 (deactivated PSCell) for FR1.

The value of TEvaluate\_BFD\_SSB is defined in Table 8.5.2.2-2 or Table 8.5.2.2-5 (deactivated PSCell) for FR2 with scaling factor N=8 for FR2-1 and N=12 for FR2-2, for FR2 power classes other than power class 6 or for FR2 power class 6 when *highSpeedMeasFlagFR2-r17* is not configured.

The value of TEvaluate\_BFD\_SSB is defined in Table 8.5.2.2-3 for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*.

For a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

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

- Ntotal / Noutside\_MG in FR1

- Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0

- Ntotal / Navailable in FR2 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 or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any BFD-RS resource occasion:

- Ntotal is the total number of BFD-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 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 within the window W

- TL1 is periodicity of the target BFD-RS.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s),

For FR1,

- , 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 SSB.

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

For FR2

- , when BFD-RS resource is not overlapped with GAPs and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P = Psharing factor, when the BFD-RS resource is not overlapped with GAP and the BFD-RS resource is fully overlapped with SMTC occasion (TSSB = TSMTCperiod).

- , when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with GAP and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TSSB < 0.5\*TSMTCperiod

- , when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with GAP and TSMTCperiod = xRP and TSSB = 0.5\*TSMTCperiod

- , when the BFD-RS resource is partially overlapped with GAP (TSSB <xRP) and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with GAP.

- , when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with GAP (TSMTCperiod < xRP)

where,

- Psharing factor = 1, if the BFD-RS resource outside gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

- 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*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, given the SMTC offset of all CCs in FR2 provided the same offset.

- When a measurement gap is configured only and the measurement gap is not NCSG,

- a BFD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG only, a BFD-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,

- a BFD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if

- it overlaps the VIL1 or VIL2 of NCSG, or

it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

- and

- xRP = VIRP

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG measurement gap(s) are configured, a BFD-RS resource or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

Longer evaluation period would be expected if the combination of BFD-RS resource, SMTC occasion and GAP configurations does not meet pervious conditionsFor either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

Table 8.5.2.2-1: Evaluation period TEvaluate\_BFD\_SSB for FR1

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_SSB (ms) |
| no DRX | Max(50, Ceil(5 × P) × TSSB) |
| DRX cycle ≤ 320ms | Max(50, Ceil(7.5 × P) × Max(TDRX,TSSB)) |
| DRX cycle > 320ms | Ceil(5 × P) × TDRX |
| Note: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length. | |

Table 8.5.2.2-2: Evaluation period TEvaluate\_BFD\_SSB for FR2

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_SSB (ms) |
| no DRX | Max(50, Ceil(5 × P × N) × TSSB) |
| DRX cycle ≤ 320ms | Max(50, Ceil(7.5 × P × N) × Max(TDRX,TSSB)) |
| DRX cycle > 320ms | Ceil(5 × P × N) × TDRX |
| Note: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length. | |

Table 8.5.2.2-3: Evaluation period TEvaluate\_BFD\_SSB for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_SSB (ms) |
| no DRX | Max(50, Ceil(5 × P × N Note2) × TSSB) |
| DRX cycle ≤ 80ms | Max(50, Ceil(7.5 × P × N Note2) × Max(TDRX,TSSB)) |
| Note 1: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length.  Note 2: scaling factor N=2 when *highSpeedMeasFlagFR2-r17* is configured to set1 or scaling factor N=6 when *highSpeedMeasFlagFR2-r17* is configured to set2, if UE is not supporting [*simultaneousReceptionFR2HST-r18*] or when highSpeedDeploymentTypeFR2-r17 is not configured as bidirectional; Scaling factor N=[TBD] when highSpeedMeasFlagFR2-r17 is configured to set1 or scaling factor N=[4] when highSpeedMeasFlagFR2-r17 is configured to set2, if UE is supporting [*simultaneousReceptionFR2HST-r18*] and when highSpeedDeploymentTypeFR2-r17 is configured as bidirectional. | |

Table 8.5.2.2-4: Evaluation period TEvaluate\_BFD\_SSB for deactivated PSCell in FR1

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_SSB (ms) |
| no DRX | Ceil(5 × P) × measCyclePscell |
| DRX cycle ≤ 320ms | Ceil(7.5 × P) × Max(measCyclePscell, TDRX) |
| DRX cycle > 320ms | Ceil(5 × P) × Max(measCyclePscell, TDRX) |
| Note: DRX cycle is the configured DRX cycle of the PSCell. measCyclePSCell is the measurement cycle length of the deactivated PSCell. | |

Table 8.5.2.2-5: Evaluation period TEvaluate\_BFD\_SSB for deactivated PSCell in FR2

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_SSB (ms) |
| no DRX | Ceil(5 × P × N) × measCyclePscell |
| DRX cycle ≤ 320ms | Ceil(7.5 × P × N) × Max(measCyclePscell, TDRX) |
| DRX cycle > 320ms | Ceil(5 × P × N) × Max(measCyclePscell, TDRX) |
| Note: DRX cycle is the configured DRX cycle of the PSCell. measCyclePSCell is the measurement cycle length of the deactivated PSCell. | |

**-------------END OF CHANGE 5: 8.5.2.2 [R4-2317295] --------------**

**------------ START OF CHANGE 6: 8.5.3.2 [R4-2317295] --------------**

8.5.3 Requirements for CSI-RS based beam failure detection

**<unchanged sections omitted>**

#### 8.5.3.2 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 ms period becomes worse than the threshold Qout\_LR\_CSI-RS within TEvaluate\_BFD\_CSI-RS ms period.

The value of TEvaluate\_BFD\_CSI-RS is defined in Table 8.5.3.2-1 or Table 8.5.3.2-3 (deactivated PSCell) for FR1.

The value of TEvaluate\_BFD\_CSI-RS is defined in Table 8.5.3.2-2 or Table 8.5.3.2-4 (deactivated PSCell) for FR2 with N=1. 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 a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

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

- Ntotal / Noutside\_MG in FR1

- Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0

- Ntotal / Navailable in FR2 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 or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any BFD-RS resource occasion:

- Ntotal is the total number of BFD-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 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 within the window W

TL1 is periodicity of the target BFD-RS.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s),

For FR1,

- , 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.

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

For FR2,

- P = 1, when the BFD-RS resource is not overlapped with GAP and also not overlapped with SMTC occasion.

- , when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is not overlapped with SMTC occasion (TCSI-RS < xRP)

- , when the BFD-RS resource is not overlapped with GAP and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P = Psharing factor, when the BFD-RS resource is not overlapped with GAP and the BFD-RS resource is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- , when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with GAP and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xGRP and TCSI-RS < 0.5 × TSMTCperiod

- , when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with GAP and TSMTCperiod = xRP and TCSI-RS = 0.5 × TSMTCperiod

- , when the BFD-RS resource is partially overlapped with GAP (TCSI-RS < xRP) and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with GAP.

- , when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with GAP (TSMTCperiod < xRP)

where,

- Psharing factor = 1, if the BFD-RS resource outside gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

- 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*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

- When a measurement gap is configured only and the measurement gap is not NCSG,

- a BFD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG only, a BFD-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,

- a BFD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if

- it overlaps the VIL1 or VIL2 of NCSG, or

- it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

- and

- xRP = VIRP

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG measurement gap(s) are configured, a BFD-RS resource or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

Note: The overlap between CSI-RS for BFD and SMTC means that CSI-RS for BFD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the BFD-RS resource, SMTC occasion and GAP configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

The values of MBFD used in Table 8.5.3.2-1 and Table 8.5.3.2-2 are defined as

- MBFD = 10, if the CSI-RS resource(s) in set  used for BFD is transmitted with Density = 3 and over the bandwidth ≥ 24 PRBs.

The values of PBFD used in Table 8.5.3.2-1 and Table 8.5.3.2-2 are defined as

For each CSI-RS resource in the set  configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- PBFD = 1.

For each CSI-RS resource in the set  configured for PSCell in NR-DC

- PBFD = 2 if UE is configured for beam failure detection on SCell, 1 otherwise.

For each CSI-RS resource in the set  configured for a SCell

- PBFD = Z in EN-DC or NE-DC or SA.

- PBFD = 2\* Z in NR-DC.

- Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell.

Table 8.5.3.2-1: Evaluation period TEvaluate\_BFD\_CSI-RS for FR1

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_CSI-RS (ms) |
| no DRX | Max(50, Ceil(MBFD × P × PBFD) × TCSI-RS) |
| DRX cycle ≤ 320ms | Max(50, Ceil(1.5 × MBFD × P × PBFD) × Max(TDRX, TCSI-RS)) |
| DRX cycle > 320ms | Ceil(MBFD × P × PBFD) × TDRX |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set . TDRX is the DRX cycle length. | |

Table 8.5.3.2-2: Evaluation period TEvaluate\_BFD\_CSI-RS for FR2

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_CSI-RS (ms) |
| no DRX | Max(50, Ceil(MBFD × P × N × PBFD) × TCSI-RS) |
| DRX cycle ≤ 320ms | Max(50, Ceil(1.5 × MBFD × P × N × PBFD) × Max(TDRX, TCSI-RS)) |
| DRX cycle > 320ms | Ceil(MBFD × P × N × PBFD) × TDRX |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set . TDRX is the DRX cycle length. | |

Table 8.5.3.2-3: Evaluation period TEvaluate\_BFD\_CSI-RS for deactivated PSCell in FR1

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_BFD\_CSI-RS (ms)** |
| no DRX | Ceil(MBFD × P × PBFD) × measCyclePscell |
| DRX cycle ≤ 320ms | Ceil(1.5 × MBFD × P × PBFD) × Max(TDRX, measCyclePscell) |
| DRX cycle > 320ms | Ceil(MBFD × P × PBFD) × Max(TDRX, measCyclePscell) |
| Note: DRX cycle is the configured DRX cycle of the PSCell. measCyclePSCell is the measurement cycle length of the deactivated PSCell. | |

Table 8.5.3.2-4: Evaluation period TEvaluate\_BFD\_CSI-RS for deactivated PSCell in FR2

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_BFD\_CSI-RS (ms)** |
| no DRX | Ceil(MBFD × P × N × PBFD) × measCyclePscell |
| DRX cycle ≤ 320ms | Ceil(1.5 × MBFD × P × N × PBFD) × Max(TDRX, measCyclePscell) |
| DRX cycle > 320ms | Ceil(MBFD × P × N × PBFD) × Max(TDRX, measCyclePscell) |
| Note: DRX cycle is the configured DRX cycle of the PSCell. measCyclePSCell is the measurement cycle length of the deactivated PSCell. | |

**-------------END OF CHANGE 6: 8.5.3.2 [R4-2317295] --------------**

**------------ START OF CHANGE 7: 8.5.5.2 [R4-2317295] --------------**

8.5.5 Requirements for SSB based candidate beam detection

**<unchanged sections omitted>**

#### 8.5.5.2 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 ms period becomes better than the threshold Qin\_LR provided SSB\_RP and SSB Ês/Iot are according to Annex Table B.2.4.1 for a corresponding band.

The UE shall monitor the configured SSB resources using the evaluation period in table 8.5.5.2-1 and 8.5.5.2-2 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320ms.

The value of TEvaluate\_CBD\_SSB is defined in Table 8.5.5.2-1 for FR1.

The value of TEvaluate\_CBD\_SSB is defined in Table 8.5.5.2-2 for FR2 with scaling factor N=8 for FR2-1 and N=12 for FR2-2.

For a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

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

- Ntotal / Noutside\_MG in FR1

- Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0

- Ntotal / Navailable in FR2 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 or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any CBD-RS resource occasion:

- Ntotal is the total number of CBD-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 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 within the window W

- TL1 is periodicity of the target CBD-RS.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s),

For FR1,

- , 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 SSB,

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

For FR2,

- , when candidate beam detection RS is not overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is Psharing factor, when candidate beam detection RS is not overlapped with GAP and candidate beam detection RS is fully overlapped with SMTC occasion (TSSB = TSMTCperiod).

- , when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with GAP and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TSSB < 0.5 × TSMTCperiod

- , when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with GAP and TSMTCperiod = xRP and TSSB = 0.5 × TSMTCperiod

- , when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with GAP

- , when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with GAP (TSMTCperiod < xRP)

where,

- Psharing factor = 1, if the CBD-RS resource outside gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

- If the high layer in TS 38.331 [2] signaling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.* TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

- When a measurement gap is configured only and the measurement gap is not NCSG,

- a CBD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG only, an CBD-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG is measurement gap only is configured,

- a CBD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if

- it overlaps the VIL1 or VIL2 of NCSG, or

- it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

- and

- xRP = VIRP

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG measurement gap(s) are configured, a CBD-RS resource or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and GAP configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

The values of PCBD used in Table 8.5.5.2-1 and Table 8.5.5.2-2 are defined as

For each SSB resource in the set  configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- PCBD = 1.

For each SSB resource in the set  configured for PSCell in NR-DC

- PCBD = 2 if UE is configured for candidate beam detection on SCell, 1 otherwise.

For each SSB resource in the set  configured for a SCell

- PCBD = Z in EN-DC or NE-DC or SA.

- PCBD = 2\* Z in NR-DC.

- Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell

- PCBD is the number of band(s) on which UE is performing candidate beam detection only for SCell.

Table 8.5.5.2-1: Evaluation period TEvaluate\_CBD\_SSB for FR1

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_CBD\_SSB (ms)** |
| non-DRX, DRX cycle ≤ 320ms | Max(25, Ceil(3 × P × PCBD) × TSSB) |
| DRX cycle > 320ms | Ceil(3 × P × PCBD) × TDRX |
| Note: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length. | |

Table 8.5.5.2-2: Evaluation period TEvaluate\_CBD\_SSB for FR2

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_CBD\_SSB (ms)** |
| non-DRX, DRX cycle ≤ 320ms | Max(25, Ceil(3 × P × N × PCBD) × TSSB) |
| DRX cycle > 320ms | Ceil(3 × P × N × PCBD) × TDRX |
| Note: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length. | |

**-------------END OF CHANGE 7: 8. 5.5.2 [R4-2317295] --------------**

**------------ START OF CHANGE 8: 8.5.6.2 [R4-2317295] --------------**

8.5.6 Requirements for CSI-RS based candidate beam detection

**<unchanged sections omitted>**

#### 8.5.6.2 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 [ms] period becomes better than the threshold Qin\_LR within TEvaluate\_CBD\_CSI-RS [ms] period provided CSI-RS Ês/Iot is according to Annex Table B.2.4.2 for a corresponding band.

The UE shall monitor the configured CSI-RS resources using the evaluation period in table 8.5.6.2-1 and 8.5.6.2-2 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320ms.

The value of TEvaluate\_CBD\_CSI-RS is defined in Table 8.5.6.2-1 for FR1.

The value of TEvaluate\_CBD\_CSI-RS is defined in Table 8.5.6.2-2 for FR2 with scaling factor N=8 for FR2-1 and N=12 for FR2-2.

For a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

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

- Ntotal / Noutside\_MG in FR1

- Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0

- Ntotal / Navailable in FR2 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 or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any CBD-RS resource occasion:

- Ntotal is the total number of CBD-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 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 within the window W

- TL1 is periodicity of the target CBD-RS.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s),

For FR1,

- , 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.

For FR2,

- P = 1, when candidate beam detection RS is not overlapped with GAP and also not overlapped with SMTC occasion.

- when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is not overlapped with SMTC occasion (TCSI-RS < xRP)

- , when candidate beam detection RS is not overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P =Psharing factor, when candidate beam detection RS is not overlapped with GAP and candidate beam detection RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- ,, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with GAP and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TCSI-RS < 0.5 × TSMTCperiod

- , when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with GAP and TSMTCperiod = xRP and TCSI-RS = 0.5 × TSMTCperiod

- , when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with GAP

- ,, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with GAP (TSMTCperiod < xRP)

where,

- Psharing factor = 1, if the CBD-RS resource outside gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

- If the high layer in TS 38.331 [2] signaling of *smtc2* is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

- When a measurement gap is configured only and the measurement gap is not NCSG,

- a CBD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if it overlaps the measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG only, an CBD-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,

- a CBD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if

- it overlaps the VIL1 or VIL2 of NCSG, or

- it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

- and

- xRP = VIRP

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG measurement gap(s) are configured, a CBD-RS resource or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

Note: The overlap between CSI-RS for CBD and SMTC means that CSI-RS for CBD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and GAP configurations does not meet pervious conditions.

Longer evaluation period would be expected if the CSI-RS is on the same OFDM symbols with RLM, BFD, BM-RS, or other CBD-RS, according to the measurement restrictions defined in clause 8.5.6.3.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

The values of MCBD used in Table 8.5.6.2-1 and Table 8.5.6.2-2 are defined as

- MCBD = 3, if the CSI-RS resource configured in the set  is transmitted with Density = 3 and over the bandwidth ≥ 24 PRBs.

The values of PCBD used in Table 8.5.6.2-1 and Table 8.5.6.2-2 are defined as

- For each CSI-RS resource in the set  configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- PCBD = 1.

- For each CSI-RS resource in the set  configured for PSCell in NR-DC

- PCBD = 2 if UE configured for candidate beam detection on SCell, 1 otherwise.

- For each CSI-RS resource in the set  configured for a SCell

- PCBD = Z in EN-DC or NE-DC or SA.

- PCBD = 2\* Z in NR-DC.

- Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell

- PCBD is the number of band(s) on which UE is performing candidate beam detection only for SCell.

Table 8.5.6.2-1: Evaluation period TEvaluate\_CBD\_CSI-RS for FR1

|  |  |
| --- | --- |
| **Configuration** | **TEvaluateC\_CBD\_CSI-RS (ms)** |
| non-DRX, DRX cycle ≤ 320ms | Max(25, Ceil(MCBD × P × PCBD) × TCSI-RS) |
| DRX cycle > 320ms | Ceil(MCBD × P × PCBD) × TDRX |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set . TDRX is the DRX cycle length. | |

Table 8.5.6.2-2: Evaluation period TEvaluate\_CBD\_CSI-RS for FR2

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_CBD\_CSI-RS (ms)** |
| non-DRX, DRX cycle ≤ 320ms | Max(25, Ceil(MCBD × P × N × PCBD) × TCSI-RS) |
| DRX cycle > 320ms | Ceil(MCBD × P × N × PCBD) × TDRX |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set . TDRX is the DRX cycle length. | |

**-------------END OF CHANGE 8: 8.5.6.2 [R4-2317295] --------------**

**------------ START OF CHANGE 9: 8.5A.2.2 [R4-2317295] --------------**

## 8.5A Link Recovery Procedures when CCA is used on target frequency

**<unchanged sections omitted>**

### 8.5A.2 Requirements for SSB based beam failure detection

**<unchanged sections omitted>**

#### 8.5A.2.2 Minimum requirement

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

The value of TEvaluate\_BFD\_SSB\_CCA is defined in Table 8.5A.2.2-1 for FR1.

The value of TEvaluate\_BFD\_SSB\_CCA is defined in Table 8.5A.2.2-2 for FR2-2 with scaling factor N=12.

For a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

- P value for a BFD-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 or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any BFD-RS resource occasion:

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

- Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s),

- , 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 BFD-RS SSB.

- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the BFD-RS SSB.

- When a measurement gap is configured only and the measurement gap is not NCSG,

- a BFD-RS resource is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG, a BFD-RS resource is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,

- a BFD-RS resource is considered to be overlapped with the GAP if it overlaps the VIL1 or VIL2 of NCSG, and

- xRP = VIRP

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG measurement gap(s) are configured, a BFD-RS resource is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

For FR2-2,

- , when BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P = Psharing factor, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion (TSSB = TSMTCperiod).

- , when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TSSB < 0.5\*TSMTCperiod

- , when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TSSB = 0.5\*TSMTCperiod

- , when the BFD-RS resource is partially overlapped with measurement gap (TSSB <MGRP) and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap.

- , when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

Where,

- Psharing factor = 1, if the BFD-RS resource outside measurement gap is

- not overlapped with the SSB symbols indicated by SSB-ToMeasure and K data symbol before each consecutive SSB symbols indicated by SSB-ToMeasure and K data symbol after each consecutive SSB symbols indicated by SSB-ToMeasure, given that SSB-ToMeasure is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and K is defined in clause 9.2.5.3.3, and;

- not overlapped with the RSSI symbols indicated by ss-RSSI-Measurement and K data symbol before each RSSI symbol indicated by ss-RSSI-Measurement and K data symbol after each RSSI symbol indicated by ss-RSSI-Measurement, given that ss-RSSI-Measurement is configured, and K is defined in clause 9.2.5.3.3.

- Psharing factor = 3, otherwise.

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*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2-2 band, given the SMTC offset of all CCs in FR2-2 provided the same offset.

Longer evaluation period would be expected if the combination of BFD-RS SSB resource, SMTC occasion and GAP configurations does not meet pervious conditions.

Table 8.5A.2.2-1: Evaluation period TEvaluate\_BFD\_SSB\_CCA for FR1

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_BFD\_SSB\_CCA (ms) | |
|  | BFD-RS SSB Es/Iot Note2 ≥ -7 dB | BFD-RS SSB Es/Iot Note2 < -7 dB |
| no DRX | Max(50, Ceil((10 × P) × TSSB)) | Max(50, Ceil((12 × P) × TSSB)) |
| DRX cycle ≤ 320ms | Max(50, Ceil(1.5 × 8 × P) × Max(TDRX,TSSB)) | Max(50, Ceil(1.5 × 10 × P) × Max(TDRX,TSSB)) |
| DRX cycle > 320ms | Ceil(7 × P) × TDRX | Ceil(8 × P) × TDRX |
| Note 1: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length.  Note 2: BFD-RS SSB Es/Iot is the averaged BFD-RS SSB Es/Iot over the most recent previous evaluation period. | | |

Table 8.5A.2.2-2: Evaluation period TEvaluate\_BFD\_SSB\_CCA for FR2-2

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_SSB\_CCA (ms) |
|  |
| no DRX | Max(200, Ceil([12]\*P\* N)\*TSSB) |
| DRX cycle ≤ 320ms | Max(200, Ceil(1.5\*[10]\*P\* N)\*Max(TDRX,TSSB)) |
| DRX cycle > 320ms | Ceil([10]\*P\* N)\*TDRX |
| Note 1: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length. | |

**-------------END OF CHANGE 9: 8.5A.2.2 [R4-2317295] --------------**

**------------ START OF CHANGE 10: 8.5A.5.2 [R4-2317295] --------------**

### 8.5A.5 Requirements for SSB based candidate beam detection

**<unchanged sections omitted>**

#### 8.5A.5.2 Minimum requirement

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

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

The value of TEvaluate\_CBD\_SSB\_CCA is defined in Table 8.5A.5.2-1 for FR1.

The value of TEvaluate\_CBD\_SSB\_CCA is defined in Table 8.5A.5.2-2 for FR2-2 with scaling factor N=TBD.

For FR1,

- For a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

- P value for a CBD-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 or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any CBD-RS resource occasion:

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

- Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s),

- , 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 CBD-RS SSB,

- P = 1 when in the monitored cell there are no GAPs overlapping with any occasion of the CBD-RS SSB.

For FR2-2,

- , when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is Psharing factor, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion (TSSB = TSMTCperiod).

- , when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TSSB < 0.5 × TSMTCperiod

- , when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TSSB = 0.5 × TSMTCperiod

- , when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap

- , when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

- Psharing factor = 1, if the candidate beam detection RS outside measurement gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and TBD data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and TBD data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;

- not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and TBD data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and TBD data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured

- Psharing factor = 3, otherwise.

where,

- If the high layer in TS 38.331 [2] signaling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.* TSMTCperiod is the shortest SMTC period among all CCs in the same FR2-2 band, provided the SMTC offset of all CCs in FR2-2 have the same offset.

- When a measurement gap is configured only and the measurement gap is not NCSG,

- a CBD-RS resource is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG, a CBD-RS resource is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,

- a CBD-RS resource is considered to be overlapped with the GAP if it overlaps the VIL1 or VIL2 of NCSG, and

- xRP = VIRP

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG measurement gap(s) are configured, a CBD-RS resource is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

**Table 8.5A.5.2-1: Evaluation period TEvaluate\_CBD\_SSB\_CCA for FR1**

|  |  |
| --- | --- |
| Configuration | TEvaluate\_CBD\_SSB\_CCA (ms) |
| non-DRX, DRX cycle ≤ 320ms | Max(25, Ceil((3 + LCBD) × P) × TSSB) |
| DRX cycle > 320ms | Ceil((3 + LCBD) × P) × TDRX |
| Note 1: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length.  Note 2: When DRX is not configured, LCBD is the number of CBD-RS SSB occasions not available at the UE during TEvaluate\_CBD\_SSB\_CCA where LCBD ≤ LCBD,max. When DRX is configured, LCBD is the number of DRX cycles in which at least one of the CBD-RS SSB occasions not available at the UE during TEvaluate\_CBD\_SSB\_CCA where LCBD ≤ LCBD,max. The UE, which is configured with DRX, is not required to determine the availability of SSB occasions more frequent than  Once per Max(25ms, P \* TSSB) if DRX cycle ≤ 320ms,  Once per P \* TDRX if DRX cycle > 320ms.  Note 3: LCBD,max=7 for Max(TDRX, TSSB) ≤ 40 assuming TDRX=0 for non-DRX,  LCBD,max=5 for 40 < Max(TDRX, TSSB) ≤ 320,  LCBD,max=3 for TDRX > 320.  Note 4 If LCBD>LCBD,max, the UE shall assume no new candidate beams are found for this evaluation period. | |

Table 8.5A.5.2-2: Evaluation period TEvaluate\_CBD\_SSB\_CCA for FR2-2

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_CBD\_SSB\_CCA (ms)** |
| non-DRX, DRX cycle ≤ 320ms | Max(25, Ceil((3 + LCBD) × P× N) × TSSB) |
| DRX cycle > 320ms | Ceil((3 + LCBD) × P × N) × TDRX |
| Note 1: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length.  Note 2: When DRX is not configured, Lin is the number of CBD-RS SSB occasions group which are not available at the UE during TEvaluate\_CBD\_SSB,CCA, where LCBD ≤ LCBD,max. A CBD-RS SSB occasions group consists of N consecutive CBD-RS SSB occasions, and the CBD-RS SSB occasions group is not available at the UE when at least one CBD-SSB occasion in the group is not transmitted by the gNB. When DRX is configured, Lin is the number of DRX cycles groups which are not available at the UE during TEvaluate\_CBD\_SSB,CCA, where Lin ≤ LCBD,max. A DRX group consists of N DRX cycles, and the DRX group is not available when there is at least one DRX in which at least one CBD-RS SSB occasion is not available. The UE is not required to determine the availability of SSB occasions more frequent than once per DRX cycle length, when configured with DRX.  Note 3: LCBD,max=7 for Max(TDRX, TSSB) ≤ 40 assuming TDRX=0 for non-DRX,  LCBD,max=5 for 40 < Max(TDRX, TSSB) ≤ 320,  LCBD,max=3 for TDRX > 320.  Note 4: If LCBD>LCBD,max, the UE shall assume no new candidate beams are found for this evaluation period. | |

**-------------END OF CHANGE 10: 8. 8.5A.5.2 [R4-2317295] --------------**

**------------ START OF CHANGE 11: 8.19.x [R4-2317293] --------------**

### 8.19.x Activation/deactivation delay requirements for multiple pre-configured measurement gaps

The requirements in this clause apply to a UE configured with multiple pre-configured measurement gaps within concurrent gaps.

#### 8.19.x.1 Activation/deactivation delay requirements for non-overlapped activation/deactivation of multiple pre-configured measurement gaps

The requirements in this clause only apply when the activation/deactivation procedures of the individual pre-configured measurement gaps do not overlap in time.

When multiple pre-configured measurement gaps are activated/deactivated non-overlapped upon DCI/timer-based BWP switch, upon SCell activation/deactivation or upon RRC reconfiguration, for each individual pre-configured measuremeng gap, the requirements defined in clauses 8.19.2, 8.19.3 and 8.19.4 apply.

#### 8.19.x.2 Activation/deactivation delay requirements for fully overlapped activation/deactivation of multiple pre-configured measurement gaps

The requirements in this clause only apply when the activation/deactivation procedures of the individual pre-configured measurement gaps fully overlap in time.

Fully overlapped activation/deactivation of pre-configured measuremeng gaps can occur in the following cases:

* Both pre-configured measurement gaps are triggered by the same event.
* Two pre-configured measurement gaps are triggered by two events of the same type at the same time.

When multiple pre-configured measuremeng gaps are activated/deactivated simultaneously, the activation/deactivation delay equals the delay requirements defined at clause 8.19.2, 8.19.3 and 8.19.4 for DCI/timer-based BWP switch, SCell activation/deactivation or RRC reconfiguration, respectively, plus an additional 2ms post-processing time.

#### 8.19.x.3 Pre-configured measurement gap activation/deactivation delay when colliding with a measurement gap

When the pre-configured measurement gap activation procedure is overlapped with one measurement gap occasion and the pre-configured measurement gap has higher priority, the pre-configured gap activation shall be applied 5ms after the overlapping measurement gap.

When the pre-configured measurement gap deactivation procedure is overlapped with one measurement gap occasion and the pre-configured measurement gap has higher priority, or when the pre-configured measurement gap activation/deactivation procedure is overlapped with one measurement gap occasion and the measurement gap has higher priority, requirements specified in 8.19.2 apply.

**-------------END OF CHANGE 11: 8.19.x [R4-2317293] --------------**

**------------ START OF CHANGE 12: 9.1.x [R4-2317294] --------------**

### 9.1.x Concurrent measurement gaps with Pre-MG

#### 9.1.x.1 Introduction

When UE supports [ConMGs with Pre-MG] capability, network can provide multiple measurement gap patterms with at least one of the measurement gaps is pre-configured measurement gap (Pre-MG) pattern configured by RRC message(s) as specified in TS 38.331 [2]. Requirements in this section apply when the UE is in SA operation mode.

#### 9.1.x.2 Requirements

If the UE requires measurement gaps and/or Pre-MGs to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports [ConMGs with Pre-MG] but 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 can provide the UE with not more than two per-UE measurement gap patterns for monitoring all the frequency layers.

*Editor Notes: FFS additional capability for UE to support Pre-MG+Pre-MG*

Two Pre-MGs may be configured by the network only if the UE supports [Pre-MG+Pre-MG].

If the UE supports both [ConMGs with Pre-MG] and independent measurement gap patterns for different frequency ranges as specified in Table 5.1-1 in [18, 19, 20], in order for the requirements defined for concurrent measurement gaps with Pre-MG to apply, the network can provide the measurement gap patterns’combinations specified in Table 9.1.x.1 for monitoring of all frequency layers.

Table 9.1.x-1: The number of Gap Combination Configurations by UE supporting both [ConMGs with Pre-MG] and independent measurement gap patterns

|  |  |  |  |
| --- | --- | --- | --- |
| Gap Combination  Configuration Id | The number of simultaneous configured measurement gap patterns | | |
| Per-FR1 measurement gap | Per-FR2 measurement gap | Per-UE measurement gap |
| 0 | 2 | 1 | 0 |
| 1 | 1 | 2 | 0 |
| 2 | 0 | 0 | 2 |
| 3Note 1 | 1 | 0 | 1 |
| 4Note 1 | 0 | 1 | 1 |
| 5Note 1 | 1 | 1 | 1 |
| 6 | 2 | 0 | 0 |
| 7 | 0 | 2 | 0 |
| Note 1: Gap Combination Configuration Id #3, #4, #5 are only applicable when the per-UE measurement gap is associated to measure PRS for any RSTD, PRS-RSRP, UE Rx-Tx time difference measurement and PRS-RSRPP measurement defined in TS 38.215 [4].  [Note 2]: For UE capable of [Concurrent Pre-MG], up to 2 measurement gap patterns can be configured as Pre-MG in one FR, regardless of whether they are per-UE or per-FR configuration. Otherwise, the gaps can only be configured as Type-1/2 MG.  Note 3: In Gap Combination Configuration Id #0, #1, #6, #7, one per-FR measurement gap in an FR can be associated to measure PRS for any RSTD, PRS-RSRP, PRS-RSRPP, RSCP, RSCPD and UE Rx-Tx time difference measurement defined in TS 38.215 [4] provided that UE supports *independentGapConfigPRS-r17*. | | | |

When UE supports [Concurrent Pre-MG], the gap association for a frequency layer is configured by the network via [*gapAssociation*] in [*ToBeMeasureConfig*]. In this case the gap association rules in clause 9.1.8.2 shall also apply to either measurement gap or Pre-MG.

When autonomous mechanism [1] is used for activation/deactivation of Pre-MG pattern, the UE shall autonomously determine the Pre-MG status only based on the measurement objects associated with the concerned Pre-MG. The related Pre-MG autonomous activation/deactivation mechanism is specified in clause 9.1.7.3.1.

When network-controlled mechanism [1] is used for activation/deactivation, the requirements specified in clause 9.1.7.3.2 apply.

When UE supports [Concurrent Pre-MG], where at least one of the concurrent gaps is Pre-MG, for a measurement gap pattern supported by the UE is listed in Table 9.1.2-1 based on the applicability specified in table 9.1.2-3.

The requirements in clause 9.1.2 are applicable for the UE capable of [Concurrent Pre-MG] and configured with multiple concurrent measurement gap patterns within each activated Pre-MG pattern.

#### 9.1.x.3 Collisions involving Pre-MG(s)

Collisions between a Pre-MG and a measurement gap may occur only when the Pre-MG is activated. No collisions can occur between a per-FR Pre-MG and a per-FR measurement gap when they are configured in different FRs.

Collisions between two Pre-MGs may occur only when both Pre-MGs are activated. No collisions can occur between a per-FR Pre-MGs when they are configured in different FRs.

The requirements for [concurrent measurement gaps with Pre-MG] apply provided that the two measurement gaps(at least one of the gaps is activated Pre-MG) colliding with each other are configured with different priorities.

#### 9.1.x.4 Collision between Pre-MG activation/deactivation and measurement gap

A measurement gap occasion and a Pre-MG activation/deactivation procedure collide when the ending point of the Pre-MG activation/deactivation procedure occurs anywhere within a time period starting 4ms before the starting point of the gap occasion and ending 4ms after the ending point of the gap occasion. The ending point of the Pre-MG activation/deactivation procedure are defined in clause [8.x.y].

When a collision occurs between a measurement gap occasion and a Pre-MG activation procedure, and the Pre-MG is configured with higher priority, the UE shall perform measurements during the measurement gap occasion and the activation of the Pre-MG is delayed until 5ms after the ending point of the measurement gap occasion.

When a collision occurs between a measurement gap occasion and a Pre-MG deactivation procedure, and the Pre-MG is configured with higher priority, the measurement gap occasion shall be dropped. The measurement gap occasion shall remain to be dropped until the ending point of the Pre-MG deactivation procedure.

When the activated Pre-MG and measurement gap meets the collision rule defined in 9.1.8.3 and the Pre-MG is configured with lower priority, the UE shall perform measurements in the occasion of the measurement gap regardless of whether colliding with the Pre-MG activation procedure.

The UE is expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI in the corresponding NR serving cells in the slots of the configured Pre-MG that are dropped according to the requirements in clause 9.1.8.4.

**-------------END OF CHANGE 12: 9.1.x [R4-2317294] --------------**

**------------ START OF CHANGE 13: 9.1.y [R4-2317296] --------------**

### 9.1.y Concurrent measurement gaps with NCSG

#### 9.1.y.1 Introduction

When UE supports [concurrent measurement gap with NCSG] capability, network can provide multiple measurement gaps with at least one of the measurement gaps is NCSG configured by RRC message(s) as specified in TS 38.331 [2].

Requirements in this section applies when the UE is in SA operation mode.

#### 9.1.y.2 Requirements

If the UE requires measurement gaps and/or NCSG to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports [*concurrentNCSGPerUE-OnlyMeasGapwithNCSG-r18*] but does not support independent measurement gap patterns for different frequency ranges as specified in [14], in order for the requirements in the following clauses to apply, the network can provide one per-UE measurement gap and one per-UE NCSG or at most two per-UE NCSGs for monitoring of all frequency layers.

If the UE requires measurement gaps and/or NCSG to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports[*concurrentNCSGPerUE-PerFRCombMeasGapwithNCSG-r18*] as specified in [14], in order for the requirements defined for concurrent measurement gaps with NCSG to apply, the network can provide the measurement gap with NCSG pattern combinations specified in Table 9.1.y-1 for monitoring of all frequency layers.

Table 9.1.y-1: The number of Gap Combination Configurations by UE supporting both concurrent measurement gap with NCSG patterns, per-FR NCSG patterns and independent measurement gap patterns

|  |  |  |  |
| --- | --- | --- | --- |
| Gap Combination  Configuration Id | The number of simultaneous configured measurement gap patterns | | |
| Per-FR1 [measurement gap] | Per-FR2 [measurement gap] | Per-UE [measurement gap] |
| 0 | 2 | 1 | 0 |
| 1 | 1 | 2 | 0 |
| 2 | 0 | 0 | 2 |
| 3Note 1 | 1 | 0 | 1 |
| 4Note 1 | 0 | 1 | 1 |
| 5Note 1 | 1 | 1 | 1 |
| 6 | 2 | 0 | 0 |
| 7 | 0 | 2 | 0 |
| Note 1: Gap Combination Configuration Id #3, #4, #5 will be only applied when the per-UE measurement gap with NCSG is concurrent MG (and cannot be NCSG) is associated to measure PRS for any RSTD, PRS-RSRP, UE Rx-Tx time difference and PRS-RSRPP measurement defined in TS 38.215 [4], and when the per-FR measurement gap with NCSG in an FR is NCSG.  [Note 2: In Gap Combination Configuration Id #0, #1, #6, #7, one per-FR measurement gap in an FR (and cannot be NCSG) can be associated to measure PRS for any RSTD, PRS-RSRP, UE Rx-Tx time difference and PRS-RSRPP measurement defined in TS 38.215 [4] provided that UE supports *independentGapConfigPRS-r17*.]  Note 3: In Gap Combination Configuration Id #0, #1, #2, #6, #7, one FR can be configured with up to 2 NCSGs, regardless they are per-UE or per-FR configured. Otherwise, the gaps can only be configured as Type-1/2 MG. | | | |

For UE configured in the SA operation mode, when monitoring of multiple inter-RAT E-UTRAN carrier frequency layers and inter-frequency NR carrier frequency layers as configured by PCell using gaps, each monitored carrier frequency layer, including following measurement types:

- a measurement object with SSB based measurement,

- a measurement object with CSI-RS based measurement,

- E-UTRA inter-RAT measurement object,

can be associated to either one measurement gap pattern or one NCSG pattern, while the following measurement types:

- E-UTRAN inter-RAT RSTD measurement,

- NR PRS-based positioning measurements,

can be only associated to one measurement gap pattern. Requirements for [concurrent measurement gaps with NCSG] apply provided that each frequency layer is only associated with one concurrent measurement gap with NCSG, and at least one of the gaps in [concurrent measurement gaps with NCSG] is NCSG. There can be one or more frequency layers associated with each concurrent measurement gap with NCSG. [Furthermore, if the UE is not capable of [concurrentMeasGapEUTRA-r17][2], all E-UTRAN measurement objects are expected to be associated with a single measurement gap or NCSG.]

When UE supports concurrent measurement gap with NCSG patterns, where at least one of the concurrent gaps is NCSG, for a measurement gap pattern supported by the UE is listed in Table 9.1.2-1 based on the applicability specified in table 9.1.2-3, while each NCSG pattern supported by the UE is listed in Table 9.1.9.3-1 based on the applicability specified in table 9.1.9.3-2.

The requirements in clause 9.1.2 are also applicable for the UE capable of and configured with multiple [concurrent measurement gap with NCSG] patterns within one measurement gap pattern. The requirements in clause 9.1.9 are also applicable for the UE capable of and configured with multiple [concurrent measurement gap with NCSG] patterns within each NCSG pattern.

#### 9.1.y.3 Collision involving NCSGs

Collisions between occasions of two [gap occasions with NCSG] may occur as specified in this clause if the two occasions are

- two per-UE NCSG, or

- two per-FR NCSG in the same FR, or

- one per-UE NCSG and one per-UE measurement gap, or

- one per-UE measurement gap and one per-FR NCSG, or

- one per-UE NCSG and one per-FR measurement gap

and if the gap collision condition specified in clause 9.1.8.3 is met then the gap collison rule applies.

When the first occasion is NCSG, the ending point is the end of VIL2 and/or when the second occasion is NCSG, the starting point is the start of VIL1.The requirements with [concurrent measurement gaps with NCSG] apply provided that two gaps (at least one of the gaps is NCSG) colliding with each other are configured with different priorities.

**-------------END OF CHANGE 13: 9.1.y [R4-2317296] --------------**

**------------ START OF CHANGE 14: 9.1.5.1 [R4-2317291/7] --------------**

#### 9.1.5.1 Monitoring of multiple layers outside gaps

For a UE supporting concurrent gaps or [concurrent gaps with Pre-MG] or [concurrent gaps with NCSG], and when concurrent [gaps] are configured 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 9.2.5 and 9.2A.5, when none of the SMTC occasions of this intra-frequency measurement object are overlapped by the union of concurrent [GAPs].

- SSB-based intra-frequency measurement with no measurement gap in clause 9.2.5 and 9.2A.5, when part of the SMTC occasions of this intra-frequency measurement object are overlapped by the union of concurrent [GAPs].

- CSI-RS based intra-frequency measurement in clause 9.10.2, when none of CSI-RS resources for L3 measurement of this intra-frequency measurement object are overlapped by the union of concurrent [GAPs].

- CSI-RS based intra-frequency measurement in clause 9.10.2, when all CSI-RS resources for L3 measurement of this intra-frequency measurement object are partially overlapped by the union of concurrent [GAPs].

- SSB-based inter-frequency measurement with no measurement gap in clause 9.3.9, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the union of concurrent [GAPs], 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 9.3.9, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the union of concurrent [GAPs], if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

Editor’s note: whether rel-17 concurrent gaps is considered with NFG in this work item is not discussed yet.

Otherwise, 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 9.2.5 and 9.2A.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 9.2.5 and 9.2A.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 9.10.2, 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 9.10.2, 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 9.3.9, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap.

- SSB-based inter-frequency measurement with no measurement gap in clause 9.3.9, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap.

- SSB-based intra-frequency measurement in clause [9.2.5] for UE supporting [NeedForGaps-r18] and reporting [‘nogap-withinterruption’] for this intra-frequency layer via [NeedForGapInfoNR-r18], when

- no measuremeng gap is configured by NW, or

- measurement gap is configured by the NW and none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap

- SSB-based intra-frequency measurement in clause [9.2.5] for UE supporting [NeedForGaps-r18] and reporting [‘nogap-nointerruption’] for this intra-frequency layer via [NeedForGapInfoNR-r18], when

- none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap, or

- part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap

- SSB-based inter-frequency measurement in clause [9.3.9] for UE supporting [NeedForGaps-r18] and within the band reporting [‘nogap-withinterruption’] via [NeedForGapInfoNR-r18], when

- no [GAP] is configured by NW, or

- measurement gap is configured by the NW and none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap

- SSB-based inter-frequency measurement in clause [9.3.9] for UE supporting [NeedForGaps-r18] reporting [‘nogap-nointerruption’] for this inter-frequency layer via [NeedForGapInfoNR-r18], when

- none 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

- For a UE in E-UTRA-NR dual connectivity operation, NR SSB-based inter-RAT measurement object configured by the E-UTRAN PCell on an NR serving carrier

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

- none or part of the SMTC occasions of this inter-RAT measurement object are overlapped by the measurement gap;

- Intra-frequency RSSI and channel occupancy measurement with no measurement gap on a carrier subject to CCA when SMTC and RMTC are overlapping and RMTCs are not fully overlapped with measurement gap(s).

- E-UTRA inter-RAT measurement object without measurement gap in clauses [9.4.v], when

- none of the EMW occasions of this inter-RAT measurement object are overlapped by the measurement gap, or

- part of the EMW occasions of this inter-RAT measurement object are overlapped by the measurement gap

Editor’s note: the scaling factor when the MG is not configured is still under discussion.

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

For a UE in E-UTRA-NR dual connectivity operation, if a measurement object configured by PSCell and an NR inter-RAT measurment object configured by E-UTRAN PCell are on the same serving carrier, they shall be counted as one intra-frequency measurement object, provided that they meet the measurement object merging conditions [in clause 9.1.3.2].

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.

The UE cell identification and measurement periods derived based on CSSFoutside\_gap,i in clauses 9.2.5.1, 9.2.5.2 and 9.10.2 may be extended for measurement objects of which the cell identification and measurement periods are overlapped with Tmeasure\_SFTD1 specified in clause 9.3.8 when no measurement gaps are provided.

The requirements in this clause apply provided that

- The SMTC on all CCs and inter-frequency layers without measurement gap in FR2 have the same offset, and one of following conditions is met

- If *smtc2* is configured on any FR2 CC,

- All CCs have the same configuration for *smtc1*, and

- All CCs configured with *smtc2* have the same configuration for *smtc2*

- If *smtc2* is not configured on any FR2 CC,

- The total number of different SMTC periodicities on all serving CCs and inter-frequency layers without measurement gap does not exceed 4

- The starting point of the first 5ms window for CSI-RS measurement as defined in clause 9.10.1 on all CCs in FR2 is same and one of following conditions is met

- If any CSI-RS resource is configured in the second 5ms window for CSI-RS measurement as defined in clause 9.10.1 on any FR2 CC,

- All CCs with CSI-RS resources only in the first 5ms window have the same CSI-RS resource periodcity, and

- All CCs with CSI-RS resources both in the first and the second 5ms window have the same CSI-RS resource periodcity

- If no CSI-RS resource is configured in the second 5ms window for CSI-RS measurement as defined in clause 9.10.1 on any FR2 CC,

- The total number of different CSI-RS resources periodicities on all serving CCs does not exceed 3Note: Longer delays for cell identification and measurement periods derived based on CSSFoutside\_gap,i in clauses 9.2.5.1, 9.2.5.2, can be expected, if the UE is configured with more than 4 different SMTC periodicities on FR2 serving carriers. The longer delay applies for the FR2 intra-frequency measurement objects with the longest SMTC periodicity/periodicities.

##### 9.1.5.1.1 EN-DC mode: carrier-specific scaling factor for SSB-based, CSI-RS based L3 measurements and RSSI and channel occupancy measurements performed outside gaps

For UE configured with the E-UTRA-NR dual connectivity operation, 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 and RSSI/channel occupancy measurement with no measurement gap on a carrier subject to CCA when SMTC and RMTC are overlapping will be as specified in Table 9.1.5.1.1-1.

Table 9.1.5.1.1-1: CSSFoutside\_gap,i scaling factor for EN-DC mode

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Scenario | *CSSF*outside\_gap,i for FR1 PSCC | *CSSF*outside\_gap,i for FR1 SCC | *CSSF*outside\_gap,i for FR2 PSCC | *CSSF*outside\_gap,i for FR2 SCC where neighbour cell measurement is required Note 2 | *CSSF*outside\_gap,i for FR2 SCC where neighbour cell measurement is not required | *CSSF*outside\_gap,i for inter-frequency MO with no measurement gp |
| **EN-DC with FR1 only CA** | 1+NPSCC\_CSIRS+NPSCC\_CCA\_RSSI/CO | NSCC\_SSB +Y+2x NSCC\_CSIRS+ NSCC\_CCA\_RSSI/CO | N/A | N/A | N/A | NSCC\_SSB +Y+2x NSCC\_CSIRS |
| **EN-DC with**  **FR2 only intra band CA** | N/A | N/A | 1+NPSCC\_CSIRS | N/A | NSCC\_SSB +Y+2x NSCC\_CSIRS | NSCC\_SSB +Y+2x NSCC\_CSIRS |
| **EN-DC with**  **FR2 only inter band CA** | N/A | N/A | 1+NPSCC\_CSIRS | 2x(1+ NSCC\_CSIRS\_FR2\_NCM) Note 3,5 | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| **EN-DC with**  **FR1 +FR2 CA (FR1 PSCell) Note 1** | 1+NPSCC\_CSIRS | 2×( NSCC\_SSB +Y+2xNSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | N/A | 2x(1+NSCC\_CSIRS\_FR2\_NCM) Note 3 | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| **EN-DC with**  **FR1 +FR2 CA (FR2 PSCell) Note 1** | N/A | NSCC\_SSB +Y+2x NSCC\_CSIRS | 1+NPSCC\_CSIRS | N/A | NSCC\_SSB+Y+2x NSCC\_CSIRS | NSCC\_SSB+Y+2x NSCC\_CSIRS |
| Note 1: Only one NR FR1 operating band and one NR FR2 operating band are included for FR1+FR2 inter-band EN-DC.  Note 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.  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: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.  Note 5: Only two NR FR2 operating band are included for EN-DC with FR2 only inter-band CA  Note 6: NPSCC\_CSIRS=1 if PSCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, NPSCC\_CSIRS =0.  Note 7: 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 8: NSCC\_CSIRS\_FR2\_NCM=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, NSCC\_CSIRS\_FR2\_NCM=0.  Note 9: NSCC\_SSB=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG.  Note 10: NPSCC\_CCA\_RSSI/CO= 1 if PSCC is configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping; NSCC\_CCA\_RSSI/CO = Number of MOs for SCell(s) configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping.  Note 11 If a measurement object configured by PSCell and an NR inter-RAT measurment object configured by E-UTRAN PCell are on the same serving carrier, they shall be counted as one intra-frequency measurement object, provided that they meet the measurement object merging conditions [in clause 9.1.3.2], otherwise they are counted separately as two measurement objects. | | | | | | |

##### 9.1.5.1.2 SA mode: carrier-specific scaling factor for SSB-based, CSI-RS based L3 measurements and RSSI and channel occupancy measurements performed outside gaps

For UE in SA operation mode, the carrier-specific scaling factor CSSFoutside\_gap,i for intra-frequency SSB-based measurements, inter-frequency SSB-based measurements performed outside measurements gaps, E-UTRA inter-RAT measurement [object] without measurement gap, intra-frequency CSI-RS L3 measurement and RSSI/channel occupancy measurement with no measurement gap on a carrier subject to CCA when SMTC and RMTC are overlapping will be as specified in Table 9.1.5.1.2-1, which shall also be applied for a UE configured with NE-DC operation.

Table 9.1.5.1.2-1: 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 FR2 PCC | *CSSF*outside\_gap,i for FR2 SCC where neighbour cell measurement is required | *CSSF* outside\_gap,i for FR2 SCC where neighbour cell measurement is not required | *CSSF*outside\_gap,i for inter-frequency MO with no measurement gap | *CSSF*outside\_gap,i for E-UTRA inter-RAT MO with no measurement gap  [TBD] |
| **FR1 only CA** | 1+NPCC\_CSIRS + NPCC\_CCA\_RSSI/CO | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS+ NSCC\_CCA\_RSSI/CO | N/A | N/A | N/A | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS |
| **FR2 only intra band CA** | N/A | N/A | 1+NPCC\_CSIRS | N/A | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS |
| **FR2 only inter band CA** | N/A | N/A | 1+NPCC\_CSIRS | 2\*(1+ NSCC\_CSIRS\_FR2\_NCM) Note 3,5 | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| **FR1 +FR2 CA (FR1 PCell) Note 1** | 1+NPCC\_CSIRS | 2×( NSCC\_SSB +Y+Z+2\* NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | N/A | 2x(1+ NSCC\_CSIRS\_FR2\_NCM) Note 3,5 | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) | 2×( NSCC\_SSB +Y+Z+2x NSCC\_CSIRS -1-NSCC\_CSIRS\_ FR2\_NCM) |
| **FR1 +FR2 CA (FR2 PCell) Note 1** | N/A | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | 1+NPCC\_CSIRS | N/A | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS | NSCC\_SSB +Y+Z+2x NSCC\_CSIRS |
| Note 1: Only one FR1 operating band and one FR2 operating band are included for FR1+FR2 inter-band CA.  Note 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.  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: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.  Note 5: Only two NR FR2 operating bands are included for FR2 inter-band CA.  Note 6: 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 7: 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 8: NSCC\_CSIRS\_FR2\_NCM=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, NSCC\_CSIRS\_FR2\_NCM=0.  Note 9: NSCC\_SSB=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG.  Note 10: NPCC\_CCA\_RSSI/CO= 1 if PSCC is configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping; NSCC\_CCA\_RSSI/CO = Number of MOs for SCell(s) configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping.  Note 11: Z is the number of configured E-UTRA inter-RAT MOs without MG that are being measured outside of MG; otherwise, it is 0. | | | | | | | |

**-------------END OF CHANGE 14: 9.1.5.1 [R4-2317291/7] --------------**

**------------ START OF CHANGE 15: 9.1.5.2 [R4-2317291/7] --------------**

#### 9.1.5.2 Monitoring of multiple layers within gaps

For a UE supporting concurrent gaps or [concurrent gaps with Pre-MG] or [concurrent gaps with NCSG], and when concurrent gaps are configured the carrier-specific scaling factor CSSFwithin\_gap,i for a measurement object *i* derived in this chapter is applied to following measurement types for the associated measurement gap:

- SSB-based intra-frequency measurement object with no measurement gap in clause 9.2.5 and 9.2A.5, when

- all of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap in concurrent [GAPs], or

- part of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of concurrent [GAPs].

- SSB-based intra-frequency measurement object with measurement gap in clause 9.2.6 and 9.2A.6.

- CSI-RS based inter-frequency measurement in clause 9.10.3, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are overlapped by the measurement gap or the associated measurement gap in concurrent [GAPs].

- CSI-RS based inter-frequency measurement in clause 9.10.3, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are partially overlapped by the measurement gap or the associated measurement gap in concurrent [GAPs].

- CSI-RS based intra-frequency measurement in clause 9.10.2, when all CSI-RS resources for L3 measurement of this intra-frequency measurement object are partially overlapped with the associated measurement gap and all CSI-RS resources for L3 measurement of this intra-frequency measurement object are overlapped with the union of the configured concurrent [GAPs].

- SSB-based inter-frequency measurement object with measurement gap in clause 9.3.4.

- SSB-based inter-frequency measurement object without measurement gap for UE capable of *interFrequencyMeas-NoGap* in clause 9.3.9, when

- all of the SMTC occasions of this inter-frequency measurement object are overlapped with the measurement gap or associated measurement gap in concurrent [GAPs], or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this inter-frequency measurement object are overlapped with the union of concurrent [GAPs], or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or associated measurement gap in concurrent [GAPs] and the flag *interFrequencyConfig-NoGap-r16* is not configured by the Network.

- NR PRS-based measurements for positioning in clause 9.9.

- E-UTRA Inter-RAT measurement object in clauses 9.4.2 and 9.4.3.

Editor’s note: whether rel-17 concurrent gaps is considered with NFG in this work item is not discussed yet.

Editor’s note: when a UE supporting [concurrent gaps with Pre-MG] is configured with [concurrent gaps with Pre-MG], for a MO associated with another deactivated Pre-MG1 but is fully overlapped with [GAP2], whether this MO should be counted when determing CSSF for [GAP2] is under discussion.

Otherwise, 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 9.2.5 and 9.2A.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 9.2.6 and 9.2A.6.

- SSB-based intra-frequency measurement in clause [9.2.5] for UE supporting [NeedForGaps-r18], and reporting [‘nogap-nointerruption’] for this intra-frequency layer via [NeedForGapInfoNR-r18], when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- SSB-based intra-frequency measurement in clause [9.2.5] for UE supporting [NeedForGaps-r18] and reporting [‘nogap-withinterruption’] for this intra-frequency layer via [NeedForGapInfoNR-r18], when

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

- part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- CSI-RS based inter-frequency measurement in clause 9.10.3, 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 9.10.3, 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 9.3.4.

- SSB-based inter-frequency measurement object without measurement gap for UE capable of *interFrequencyMeas-NoGap* in clause 9.3.9, 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.

- SSB-based inter-frequency measurement in clause [9.3.9] for UE supporting [NeedForGaps-r18] and reporting [‘nogap-nointerruption’] for this inter-frequency layer via [NeedForGapInfoNR-r18], when all of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap.

- SSB-based inter-frequency measurement in clause [9.3.9] for UE supporting [NeedForGaps-r18] and reporting [‘nogap-withinterruption’] for this inter-frequency layer via [NeedForGapInfoNR-r18], 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.

- Intra-frequency RSSI/CO measurement with measurement gap in clause 9.2A.7.

- Intra-frequency RSSI/CO measurement with no measurement gap in clause 9.2A.7 when all of the RMTC occasions of this intra-frequency RSSI/CO measurement are overlapped by the measurement gap(s).

- Inter-frequency RSSI/CO measurement in clause 9.3A.8 and 9.3A.9.

- E-UTRA Inter-RAT measurement object in clauses 9.4.2 and 9.4.3.

- E-UTRA inter-RAT measurement object causing scheduling restriction in clauses [9.4.v], when.

- EMW is configured and fully overlapped with measurement gap, and the periodicity of measurement gap and EMW is the same, or

- EMW is not configured.

[- *FFS: E-UTRA inter-RAT measurement object without measurement gap in clauses [9.4.v.1] when EMW is configured and fully overlapped with measurement gap, but the periodicity of MG is smaller than EMW.]*

- NR PRS-based measurements for positioning in clause 9.9.

- E-UTRA Inter-RAT RSTD and E-CID measurements in clauses 9.4.4 and 9.4.5.

- For a UE in E-UTRA-NR dual connectivity operation, NR SSB-based Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.4) on an NR serving carrier

- the SSB is not completely contained in the active BWP of the UE, or

- all of the SMTC occasions of this inter-RAT measurement object are overlapped by the measurement gap;

- NR SSB-based Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.4) on an NR non-serving carrier.

- E-UTRAN Inter-frequency measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.3) and by the E-UTRAN PSCell (TS 36.133 [15] clause 8.19.3).

- E-UTRAN Inter-frequency RSTD measurement configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.15).

- UTRA Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clauses 8.17.5 to 8.17.12).

- GSM Inter-RAT measurements configured by the E-UTRAN PCell (TS 36.133 [15] clauses 8.17.13 and 8.17.14).

The UE is expected to conduct the measurement of this measurement object *i* only within the measurement gap or the associated measurement gap if concurrent measurement gaps are configured. If UE is configured with concurrent measurement gaps and an association between measurement object i and certain measurement gap is provided, the requirements are defined assuming the UE shall conduct the measurement of this measurement object *i* within the associated measurement gap.

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 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.

**-------------END OF CHANGE 15: 9.1.5.2 [R4-2317291/7] --------------**

**------------ START OF CHANGE 16: 9.1.5.3 [R4-2317291] --------------**

#### 9.1.5.3 Monitoring of multiple layers within NCSG

The measurement requirements derived from CSSFwithin\_ncsg,i defined in this clause are applicable provided that network provides NCSG pattern for measurement.

For a UE supporting [concurrent gaps with NCSG] and when a gap combination including one or more NCSGs is configured, the carrier-specific scaling factor CSSFwithin\_ncsg,i derived in this chapter for a measurement object *i* associated with an NCSG is applied to following measurement types:

- SSB-based intra-frequency measurement object without measurement gap as defined in clause 9.2.1 corresponding to an activated serving cell, when

- all of the SMTC occasions of this intra-frequency measurement object are overlapped with associated NCSG in [concurrent gaps], or

- part of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated NCSG and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of all the [GAPs].

- SSB-based intra-frequency measurement object with NCSG as defined in clause 9.2.1 corresponding to an activated serving cell (in non-dormancy);

- SSB-based intra-frequency measurement object corresponding to a deactivated serving cell or to an activated serving cell in dormancy, when all or part of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG.

Edi*t*or’s note: *FFS whether to follow gap association rule*;

- SSB-based inter-frequency measurement object without measurement gap as defined in clause 9.3.1, when

- all of the SMTC occasions of this inter-frequency measurement object are overlapped with associated NCSG in [concurrent gaps], or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped with the associated NCSG and all the SMTC occasions of this inter-frequency measurement object are overlapped with the union of all the [GAPs], or

- SSB-based inter-frequency measurement object with NCSG as defined in clause 9.3.1;

- E-UTRA inter-RAT measurement object, when the measurement can be performed with no measurement gap but NCSG as defined in clause [*9.4.1*];

Otherwise, the carrier-specific scaling factor CSSFwithin\_ncsg,i for a measurement object *i* derived in this clause is applied to following measurement types:

- SSB-based intra-frequency measurement object without measurement gap as defined in clause 9.2.1 corresponding to an activated serving cell, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;

- SSB-based intra-frequency measurement object with NCSG as defined in clause 9.2.1 corresponding to an activated serving cell (in non-dormancy), when all or part of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;

- SSB-based intra-frequency measurement object corresponding to a deactivated serving cell or to an activated serving cell in dormancy, when all or part of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;

- SSB-based inter-frequency measurement object without measurement gap as defined in clause 9.3.1, when all of the SMTC occasions of this inter-frequency measurement object are overlapped by the NCSG;

- SSB-based inter-frequency measurement object with NCSG as defined in clause 9.3.1;

- E-UTRA inter-RAT measurement object, when the measurement can be performed with no measurement gap but NCSG as defined in clause 9.4;

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

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present for an intra-frequency measurement object, and *smtc1* is fully overlapping with NCSG and *smtc2* is partially overlapping with NCSG, requirements derived from CSSFwithin\_ncsg,i and CSSFoutside\_gap,i are not applicable.

##### 9.1.5.3.1 SA mode: carrier-specific scaling factor for measurements performed within NCSG

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

If a UE capable of [concurrent gaps with NCSG] is configured with a gap combination including one or more NCSGs, the carrier specific scaling factor is calculated separately for each gap pattern, [provided that the association between measurement objects and gap pattern is configured by network. Only the measurement objects associated to the same NCSG pattern are counted when deriving CSSFwithin\_ncsg,i for a target measurement object with index *i*.]. In case of collision between concurrent [measurement gaps], some NCSG occasions may be dropped according to clause [9.1.X2.x]. The dropped NCSG occasions will not be used in deriving CSSFwithin\_ncsg,i.

Editor’s note: FFS whether to remove [ ] or revise the sentence in [ ] after RAN2 concludes the implementation on RRC association.

For each NCSG occasion *j*, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects which are candidates to be measured within the occaison *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in an NCSG occasion if its SMTC duration is fully covered by the ML. 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 inter-RAT E-UTRA measurement object configured is a candidate to be measured in all NCSG occasions.

- Mintra,i,j: Number of intra-frequency measurement objects which are candidates to be measured in NCSG occasion *j* where the measurement object *i* is also a candidate. Otherwise Mintra,i,j equals 0.

- Minter,i,j : Number of NR inter-frequency measurement objects and E-UTRA inter-RAT measurement objects which are candidates to be measured in NCSG occasion *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, inter-frequency and inter-RAT measurement objects which are candidates to be measured in NCSG occasion *j* where the measurement object *i* is also a candidate. Otherwise Mtot,i,j equals 0.

For UEs which support and are configured with per FR NCSG, the above counting is done on a per FR basis, and for UEs which are configured with per UE NCSG the counting is done on a per UE basis.

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

If *measGapSharingScheme* is equal sharing, CSSFwithin\_ncsg,i= max(Mtot,i,j), where *j*=0…(160/VIRP)-1

If *measGapSharingScheme* is not equal sharing and

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

- ceil(Kintra×Mintra,i,j) in NCSG occasions where Minter,i,j≠0, where *j*=0…(160/VIRP)-1

- Mintra,i,j in NCSG occasions where Minter,i,j=0, where *j*=0…(160/VIRP)-1

- measurement object *i* is an inter-frequency or inter-RAT measurement object, CSSFwithin\_ncsg,i is the maximum among

- ceil(Kinter×Minter,i,j) in NCSG occasions where Mintra,i,j ≠0, where *j*=0…(160/VIRP)-1

- Minter,i,j in NCSG occasions where Mintra,i,j=0, where *j*=0…(160/VIRP)-1

**-------------END OF CHANGE 16: 9.1.5.3 [R4-2317291] --------------**

**--------- START OF CHANGE 17: 9.2.1 [R4-2317298] ------------**

### 9.2.1 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 or the PSCell, 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 (either legacy measurement gap or NCSG) 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].

Besides the conditions listed above,

- for UE supporting *nr-NeedForGapNCSG-reporting-r17* and indicating *NeedForGapNCSG-InfoNR* for intra-frequency measurement,

- An intra-frequency SSB measurement is defined as measurement without gap if

- the UE indicates ‘nogap-noncsg’ via *NeedForGapNCSG-InfoNR* for the intra-frequency measurement, and

- the SSB is not completely contained in the active BWP of the UE, and

- the active downlink BWP is not an initial BWP [3].

- An intra-frequency SSB measurement is defined as measurement with NCSG if

- the UE indicates ‘ncsg’ via *NeedForGapNCSG-InfoNR* for the intra-frequency measurement, and

- the SSB is not completely contained in the active BWP of the UE, and

- the active downlink BWP is not an initial BWP [3]

- An intra-frequency SSB measurement is defined as measurement with gap if

- the UE indicates ‘gap’ via *NeedForGapNCSG-InfoNR* for the intra-frequency measurement, and

- the SSB is not completely contained in the active BWP of the UE, and

- the active downlink BWP is not an initial BWP [3]

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

- For intra-frequency SSB based measurements with NCSG, UE may cause scheduling restriction as specified in clause 9.2.7.3.

- for UE supporting [*NeedForGap-InfoNR-R18*] for intra-frequency measurement,

- An intra-frequency SSB measurement is defined as measurement without gap if

- the UE indicates ‘no-gap’ via *intraFreq-needForGap* and the UE indicates ‘[*no gap without interruption*]’ or [*no gap with interruption*] via [*NeedForGap-InfoNR-R18]* for the intra-frequency measurement

- UE is not allowed to cause interruption during intra-frequency measurement without gap when UE indicate *[no gap without interruption]*

- UE is allowed to cause interruption during intra-frequency measurement without gap when UE indicate *[no gap with interruption]*, the interruption requirement is defined in [clause 8.2.2.2.X]

- An intra-frequency SSB measurement is defined as measurement with gap if

- the UE indicates ‘gap’ via intraFreq-needForGap for intra-frequency measurement

For intra-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.2.5.3.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 5ms 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 0.5ms for frequency range FR1 and 0.25ms for frequency range FR2.

The requirements in this clause shall also apply, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

The measurement requirements defined for an activated SCell with a non-dormant active BWP defined in this clause shall also apply to an activated SCell with dormant BWP as active BWP.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

*Editor Note: FFS the scenario when deactivated SCell measurement object is fully overlapping with measurement gap*

The intra-frequency measurement requirements in clause 9.2.5 applies for the following scenarios:

- SSB based intra-frequency measurements with no measurement gap,

- for a UE supporting concurrent gaps and when concurrent gaps are configured:

- When none of the SMTC occasions of this intra-frequency measurement object are overlapped by the union of concurrent measurement gaps.

- When part of the SMTC occasions of this intra-frequency measurement object are overlapped by the union of concurrent measurement gaps.

- otherwise, for a UE not supporting concurrent gaps or if concurrent gaps are not configured:

- When none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- When part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap. - SSB based intra-frequency measurements object with no measurement gap for UE capable of [*NeedForInterruptionNR-r18*],

- When UE indicates ‘no-gap’ via *intraFreq-needForGap* for intra-frequency measurement and indicates [*no gap with interruption*] or [*no gap without interruption*] via [*NeedForGap-InfoNR-R18]* for the intra-frequency measurement intra-frequency, and SMTC is fully non overlapping with GAP,

- When UE indicates ‘no-gap’ via *intraFreq-needForGap* for intra-frequency measurement and indicates [*no gap without interruption*] via [*NeedForGap-InfoNR-R18]* for the intra-frequency measurement, and SMTC is partially overlapping with GAP,

The intra-frequency measurement requirements in clause 9.2.6 applies for the following scenarios:

- SSB based intra-frequency measurements with measurement gap,

- SSB based intra-frequency measurements with no measurement gap with the following condition,

- for a UE supporting concurrent gaps and when concurrent gaps are configured:

- when all of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap in the concurrent measurement gaps, or

- when part of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of concurrent measurement gaps.

- otherwise, for a UE not supporting concurrent gaps or if concurrent gaps are not configured:

- when all of the SMTC occasions of this intra-frequency measurement object are overlapped with the measurement gap.

- SSB-based intra-frequency measurement object with NCSG, and measurement gap is configured.

- SSB based intra-frequency measurements object with no measurement gap for UE capable of [*NeedForInterruptionNR-r18*],

- When UE indicates ‘no-gap’ via *intraFreq-needForGap* for intra-frequency measurement and indicates [*no gap with interruption*] via [*NeedForGap-InfoNR-R18]* for the intra-frequency measurement, and SMTC is partially overlapping with GAP

The intra-frequency measurement requirements in clause 9.2.7 applies for the following scenarios:

* SSB based intra-frequency measurements without measurement gaps corresponding to an activated serving cell, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;
* SSB-based intra-frequency measurement object corresponding to an activated serving cell (in non-dormancy) when UE supports nr-NeedForGapNCSG-reporting-r17 and indicates ‘ncsg’ in NeedForGapNCSG-InfoNR for intra-frequency measurement and all or part of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;
* SSB-based intra-frequency measurement object corresponding to a deactivated serving cell or to an activated serving cell in dormancy when all or part of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG.

Editor’s note: RAN4 has to decide the UE behaviour when DRX is condifured whether interruptions are allowed.

**------------END OF CHANGE 17: 9.2.1 [R4-2317298] -------------**

**------------ START OF CHANGE 17: 9.2.5/6/7 [R4-2317292/8] ---------**

### 9.2.5 Intrafrequency measurements without measurement gaps

#### 9.2.5.1 Intrafrequency 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. It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2 with SCS smaller or equal to 480 kHz.

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

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

Where:

TPSS/SSS\_sync\_intra: it is the time period used in PSS/SSS detection

- For UE supporting power class 6 with *highSpeedMeasFlagFR2-r17* configured, if SMTC <= 40ms, TPSS/SSS\_sync\_intra is given in Table 9.2.5.1-11; otherwise, TPSS/SSS\_sync\_intra is given in Table 9.2.5.1-2.

- For UE indicating [no gap without interruption], TPSS/SSS\_sync\_intra is given in Table 9.2.5.1-1 for FR1 and Table 9.2.5.1-2 for FR2. For UE indicating [no gap with interruption], TPSS/SSS\_sync\_intra is given in Table 9.2.5.1-X1 for FR1 and Table 9.2.5.1-X2 for FR2.

- Otherwise, TPSS/SSS\_sync\_intra is given in table 9.2.5.1-1, 9.2.5.1-2, 9.2.5.1-4 (deactivated SCell) or 9.2.5.1-5 (deactivated SCell) or 9.2.5.1-9 (deactivated SCell) or 9.2.5.1-11 or 9.2.5.1-12 (deactivated PSCell) or 9.2.5.1-13 (deactivated PSCell).

TSSB\_time\_index\_intra: it is the time period used to acquire the index of the SSB being measured

- For UE indicatting [no gap without interruption], TSSB\_time\_index\_intra is given in Table 9.2.5.1-3 for FR1 and Table 9.2.5.1-15 for FR2-2. For UE indicating [no gap with interruption], TSSB\_time\_index\_intra is given in Table 9.2.5.1-X3 for FR1 and Table 9.2.5.1-X4 for FR2-2.

- Otherwise, TSSB\_time\_index\_intra is given in table 9.2.5.1-3, 9.2.5.1-15 (FR2-2), 9.2.5.1-6 (deactivated SCell), 9.2.5.1-10(deactivated SCell) or 9.2.5.1-14 (deactivated PSCell).

T SSB\_measurement\_period\_intra: equal to a measurement period of SSB based measurement

- For UE supporting power class 6 with *highSpeedMeasFlagFR2-r17* configured, if SMTC <= 40ms, TSSB\_measurement\_period\_intra is given in Table 9.2.5.2-7; otherwise, T SSB\_measurement\_period\_intra is given in Table 9.2.5.2-2.

- For UE indicating [no gap without interruption], TSSB\_measurement\_period\_intra is given in Table 9.2.5.2-1 for FR1 and Table 9.2.5.2-2 for FR2. For UE indicating [no gap with interruption], TSSB\_measurement\_period\_intra is given in Table 9.2.5.2-Y1 for FR1 and Table Table 9.2.5.2-Y2 for FR2.

- For UE indicating [no gap without interruption], TSSB\_measurement\_period\_intra is given in Table 9.2.5.2-1 for FR1 and Table 9.2.5.2-2 for FR2. For UE indicating [no gap with interruption], TSSB\_measurement\_period\_intra is given in Table 9.2.5.2-Y1 for FR1 and Table Table 9.2.5.2-Y2 for FR2.

- For power class 6 UE supporting [*measurementEnhancementCAInterFreqFR2-r18*] when [*highSpeedMeasFlagFR2]* is configured, the T SSB\_measurement\_period\_intra given in Table 9.2.5.2-7 (if SMTC <= 40ms) and Table 9.2.5.2-2 (if SMTC > 40ms) shall apply for SCC.

- Otherwise, T SSB\_measurement\_period\_intra is given in table 9.2.5.2-1, table 9.2.5.2-2 table 9.2.5.2-3 (deactivated SCell), 9.2.5.2-4(deactivated SCell), 9.2.5.2-5 or 9.2.5.2-6(deactivated SCell), 9.2.5.2-8(deactivated PSCell) or 9.2.5.2-9(deactivated PSCell).

CSSFintra: it is a carrier specific scaling factor and is determined

- according to CSSFoutside\_gap,i in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e.

- when intra-frequency SMTC is fully non overlapping or partially overlapping with GAP, or

- when intra-frequency SMTC is fully non overlapping with GAP for UE indicating [no gap with interruption], or

- when intra-frequency SMTC is fully non overlapping or partially overlapping with GAP for UE indicating [no gap without interruption], or

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*.

Mpss/sss\_sync\_w/o\_gaps: For a UE supporting FR2-1 power class 1 or 5, Mpss/sss\_sync\_w/o\_gaps =40. For a UE supporting power class 2, Mpss/sss\_sync\_w/o\_gaps =24. For a UE supporting FR2-1 power class 3, Mpss/sss\_sync\_w/o\_gaps =24. For a UE supporting FR2-1 power class 4, Mpss/sss\_sync\_w/o\_gaps =24. For a UE supporting FR2-2 power class 1, Mpss/sss\_sync\_w/o\_gaps = 60. For a UE supporting FR2-2 power class 2, Mpss/sss\_sync\_w/o\_gaps = 36. For a UE supporting FR2-2 power class 3, Mpss/sss\_sync\_w/o\_gaps = 36.

Mmeas\_period\_w/o\_gaps: For a UE supporting FR2-1 power class 1 or 5, Mmeas\_period\_w/o\_gaps =40. For a UE supporting FR2-1 power class 2, Mmeas\_period\_w/o\_gaps =24. For a UE supporting FR2-1 power class 3, Mmeas\_period\_w/o\_gaps =24. For a UE supporting power class 4, Mmeas\_period\_w/o\_gaps =24. For a UE supporting FR2-2 power class 1, Mmeas\_period\_w/o\_gaps = 60. For a UE supporting FR2-2 power class 2, Mmeas\_period\_w/o\_gaps = 36. For a UE supporting FR2-2 power class 3, Mmeas\_period\_w/o\_gaps = 36.

MSSB\_index\_intra: For a UE supporting FR2-2 power class 1, MSSB\_index\_intra = 72 samples. For a UE supporting FR2-2 power class 2, MSSB\_index\_intra = 48 samples. For a UE supporting FR2 power class 3, MSSB\_index\_intra = 48 samples.

When UE supports concurrent measurement GAPs, i.e., supports the following capability or capabilities’ combination:

* *concurrentMeasGap-r17*, or
* [concurrent gap with Pre-MG capability], or
* [concurrent gap with NCSG capability],

and UE is configured with concurrent measurement GAPs,

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

- For a window W of duration max(SMTC period, xRP\_max), where xRP\_max is the maximum xRP across all configured per-UE measurement GAPs and/or per-FR measurement GAPs within the same FR as the SSB frequency layer, and starting from the beginning of any SMTC occasion:

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

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

Kp = 1 when Navailable = 0.

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

- 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, 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 TS38.331 [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 FR2,

Klayer1\_measurement=1,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or

- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured, where SSB symbols are indicated by the union set of SSB-ToMeasure from all the configured measurement objects on the same serving carrier which can be merged.and RSSI symbols are indicated by *SS-RSSI-Measurement*;

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.

If MCG DRX is in use, cell identification requirements for intra-frequency measurement in MCG specified in Table 9.2.5.1-1, Table 9.2.5.1-2, Table 9.2.5.1-3, Table 9.2.5.1-4, Table 9.2.5.1-5 and Table 9.2.5.1-6 shall depend on the MCG DRX cycle. If SCG DRX is in use, cell identification requirements for intra-frequency measurement in SCG specified in Table 9.2.5.1-1, Table 9.2.5.1-2, Table 9.2.5.1-3, Table 9.2.5.1-4, Table 9.2.5.1-5, Table 9.2.5.1-6, Table 9.2.5.1-12, Table 9.2.5.1-13 and Table 9.2.5.1-14 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

When the target SSB is completely contained in active BWP of UE or the active downlink BWP is initial BWP, the intra-frequency measurement should be without gap without interruption regardless of the NeedForGaps’ status reporting.

Table 9.2.5.1-1: Time period for PSS/SSS detection, (Frequency range FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max( 600ms, ceil( 5 x Kp) x SMTC period )Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max( 600ms, ceil(M2 Note 2x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil(5 x Kp) 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: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1.  NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.  NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured and UE supports *measurementEnhancementCA-r17*, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1. | |

Table 9.2.5.1-2: Time period for PSS/SSS detection, (Frequency range FR2)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, ceil(Mpss/sss\_sync\_w/o\_gaps x KFR x Kp x Klayer1\_measurement)x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(600ms, ceil(1.5 x Mpss/sss\_sync\_w/o\_gaps x KFR x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil(Mpss/sss\_sync\_w/o\_gaps x KFR x Kp 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: KFR is a scaling factor depending on the frequency range and the SSB SCS. For FR2-1, KFR = 1. For FR2-2: KFR = 1 if the SCS of the SSB of the cell being detected is 120 kHz, KFR = 2 if the SCS of the SSB of the cell being detected is 480 kHz, and KFR = 3 if the SCS of the SSB of the cell being detected is 960 kHz. | |

Table 9.2.5.1-3: Time period for time index detection (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(120ms, ceil( 3 x Kp )x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(120ms, ceil (M2 Note 2 x 3 x Kp) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | Ceil(3 x Kp) 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: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1  NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.  NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured and UE supports *measurementEnhancementCA-r17*, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1 | |

Table 9.2.5.1-4: Time period for PSS/SSS detection, deactivated SCell (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | Ceil(5 x Kp) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(5 x Kp) x max(measCycleSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(5 x Kp) x max(measCycleSCell, DRX cycle) x CSSFintra |
| NOTE 1: The requirements also apply to deactivated SCG SCell. | |

Table 9.2.5.1-5: Time period for PSS/SSS detection, deactivated SCell (FR2)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | Ceil(Mpss/sss\_sync\_w/o\_gaps x Kp) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(Mpss/sss\_sync\_w/o\_gaps x Kp) x max(measCycleSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(Mpss/sss\_sync\_w/o\_gaps x Kp) x max(measCycleSCell, DRX cycle) x CSSFintra |
| NOTE 1: The requirements also apply to deactivated SCG SCell. | |

Table 9.2.5.1-6: Time period for time index detection, deactivated SCell (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | Ceil(3 x Kp) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(3 x Kp) x max(measCycleSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(3 x Kp) x max(measCycleSCell, DRX cycle) x CSSFintra |
| NOTE 1: The requirements also apply to deactivated SCG SCell. | |

Table 9.2.5.1-7: Void

Table 9.2.5.1-8: Void

Table 9.2.5.1-9: Time period for PSS/SSS detection, deactivated SCell (FR1), when *highSpeedMeasCA-Scell-r17* is configured

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | Ceil(5 x Kp) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(5 x Kp) x max(measCycleSCell, M2 Note 1xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(5 x Kp) x max(measCycleSCell, DRX cycle) x CSSFintra |
| NOTE 1: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1 | |

Table 9.2.5.1-10: Time period for time index detection, deactivated SCell (FR1)，when *highSpeedMeasCA-Scell-r17* is configured

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | Ceil(3 x Kp) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(3 x Kp) x max(measCycleSCell, M2 Note 1xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(3 x Kp)x max(measCycleSCell, DRX cycle) x CSSFintra |
| NOTE 1: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1 | |

Table 9.2.5.1-11: Time period for PSS/SSS detection when *highSpeedMeasFlagFR2-r17* is configured, (Frequency range FR2) when SMTC period <= 40ms

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, ceil(M1Note 2 x Kp x Klayer1\_measurement)x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 80ms | max(600ms, ceil(M1Note 2 x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra |
| 80ms< DRX cycle≤ 320ms | ceil(1.5x Mpss/sss\_sync\_w/o\_gaps Note 3 x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle) x CSSFintra |
| DRX cycle>320ms | ceil(Mpss/sss\_sync\_w/o\_gaps Note 3 x Kp 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 UE supporting power class 6, M1= 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1= 18 if *highSpeedMeasFlagFR2-r17* = set2  NOTE 3: Void | |

Table 9.2.5.1-12: Time period for PSS/SSS detection, deactivated PSCell (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | Ceil(5 x Kp) x measCyclePSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(5 x Kp) x max(measCyclePSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(5 x Kp) x max(measCyclePSCell, DRX cycle) x CSSFintra |

Table 9.2.5.1-13: Time period for PSS/SSS detection, deactivated PSCell (FR2)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | Ceil(Mpss/sss\_sync\_w/o\_gaps x Kp) x measCyclePSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(Mpss/sss\_sync\_w/o\_gaps x Kp) x max(measCyclePSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(Mpss/sss\_sync\_w/o\_gaps x Kp) x max(measCyclePSCell, DRX cycle) x CSSFintra |

Table 9.2.5.1-14: Time period for time index detection, deactivated PSCell (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | Ceil(3 x Kp) x measCyclePSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(3 x Kp) x max(measCyclePSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(3 x Kp) x max(measCyclePSCell, DRX cycle) x CSSFintra |

Table 9.2.5.1-15: Time period for time index detection (Frequency range FR2-2)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(200ms, ceil(MSSB\_index\_intra x Kp x SMTC period) x CSSFintra |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5 x MSSB\_index\_intra x Kp) x max(SMTC period, DRX cycle) x CSSFintra) |
| DRX cycle>320ms | Ceil(MSSB\_index\_intra x Kp )x DRX cycle x CSSFintra |

Table 9.2.5.1-16: Time period for time index detection (FR1) for less\_than\_5Mhz channel bandwidth UE

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra\_less\_than\_5Mhz |
| No DRX | max(120ms, ceil( [X] x Kp ) Note 2 x SMTC period)Note 1 x CSSFintra\_less\_than\_5Mhz |
| DRX cycle≤ 320ms | max(120ms, ceil (1.5 x [Y] x Kp) x max(SMTC period,DRX cycle)) x CSSFintra\_less\_than\_5Mhz |
| DRX cycle>320ms | Ceil([Z] x Kp) Note 2 x DRX cycle x CSSFintra\_less\_than\_5Mhz |
| 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 | |

Table 9.2.5.1-X1: Time period for PSS/SSS detection for UE indicating [no gap with interruption], (Frequency range FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max( 600ms, 5 x max (80ms, SMTC period ))Note 1 x CSSFintra |
| [DRX cycle≤ 320ms] | max( 600ms, ceil(M2 Note 2x 5) x [max(80ms, SMTC period,DRX cycle)]) x CSSFintra |
| [DRX cycle>320ms] | 5 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: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1.  NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.  NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured and UE supports *measurementEnhancementCA-r17*, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1. | |

Editor’s note: RAN4 has to decide the UE behaviour when DRX is condifured whether interruptions are allowed.

Table 9.2.5.1-X2: Time period for PSS/SSS detection for UE indicating [no gap with interruption], (Frequency range FR2)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, ceil(Mpss/sss\_sync\_w/o\_gaps x KFR x Klayer1\_measurement)x max (80ms, SMTC period ))Note 1 x CSSFintra |
| [DRX cycle≤ 320ms] | max(600ms, ceil(1.5 x Mpss/sss\_sync\_w/o\_gaps x KFR x Klayer1\_measurement)x [max(80ms, SMTC period,DRX cycle)]) x CSSFintra |
| [DRX cycle>320ms] | [ceil(Mpss/sss\_sync\_w/o\_gaps x KFR 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: KFR is a scaling factor depending on the frequency range and the SSB SCS. For FR2-1, KFR = 1. For FR2-2: KFR = 1 if the SCS of the SSB of the cell being detected is 120 kHz, KFR = 2 if the SCS of the SSB of the cell being detected is 480 kHz, and KFR = 3 if the SCS of the SSB of the cell being detected is 960 kHz. | |

Editor’s note: RAN4 has to decide the UE behaviour when DRX is condifured whether interruptions are allowed.

Table 9.2.5.1-X3: Time period for time index detection for UE indicating [no gap with interruption] (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(120ms, 3x max (80ms, SMTC period ))Note 1 x CSSFintra |
| [DRX cycle≤ 320ms] | max(120ms, ceil (M2 Note 2 x 3) x [max(80ms, SMTC period,DRX cycle)]) x CSSFintra |
| [DRX cycle>320ms] | 3 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: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1  NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.  NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured and UE supports *measurementEnhancementCA-r17*, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1 | |

Editor’s note: RAN4 has to decide the UE behaviour when DRX is condifured whether interruptions are allowed.

Table 9.2.5.1-X4: Time period for time index detection for UE indicating [no gap with interruption] (Frequency range FR2)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(200ms, ceil(MSSB\_index\_intra x Kp x max(80ms, SMTC period )) x CSSFintra |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5 x MSSB\_index\_intra x Kp) x max(80ms, SMTC period, DRX cycle) x CSSFintra) |
| DRX cycle>320ms | Ceil(MSSB\_index\_intra x Kp )x DRX cycle x CSSFintra |

Editor’s note: RAN4 has to decide the UE behaviour when DRX is condifured whether interruptions are allowed.

Table 9.2.5.1-X5: Time period for PSS/SSS detection when *highSpeedMeasFlagFR2-r17* is configured, (Frequency range FR2) when SMTC period <= 40ms, UE indicating [no gap with interruption]

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, ceil(M1Note 2 x Klayer1\_measurement)x max (80ms, SMTC period))Note 1 x CSSFintra |
| [DRX cycle≤ 80ms] | max(600ms, ceil(M1Note 2 x Kp x Klayer1\_measurement)x [max(80ms,SMTC period,DRX cycle)]) x CSSFintra |
| [80ms< DRX cycle≤ 320ms] | ceil(1.5x Mpss/sss\_sync\_w/o\_gaps Note 3 x Klayer1\_measurement)x max(80ms, SMTC period,DRX cycle) x CSSFintra |
| [DRX cycle>320ms] | ceil(Mpss/sss\_sync\_w/o\_gaps Note 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 UE supporting power class 6, M1= 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1= 18 if *highSpeedMeasFlagFR2-r17* = set2  NOTE 3: Void | |

Editor’s note: RAN4 has to decide the UE behaviour when DRX is condifured whether interruptions are allowed.

Table 9.2.5.1-X6: Time period for time index detection (FR1) for less\_than\_5Mhz channel bandwidth UE, UE indicating [no gap with interruption]

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra\_less\_than\_5Mhz |
| No DRX | max(120ms, ceil( [X] ) Note 2 x max (80ms,SMTC period))Note 1 x CSSFintra\_less\_than\_5Mhz |
| [DRX cycle≤ 320ms] | max(120ms, ceil (1.5 x [Y]) x [max(80ms, SMTC period,DRX cycle)]) x CSSFintra\_less\_than\_5Mhz |
| [DRX cycle>320ms] | [Z] Note 2 x DRX cycle x CSSFintra\_less\_than\_5Mhz |
| 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 | |

Editor’s note: RAN4 has to decide the UE behaviour when DRX is condifured whether interruptions are allowed.

#### 9.2.5.2 Measurement period

The measurement period for intra-frequency measurements without gaps is as shown in table 9.2.5.2-1, 9.2.5.2-2, 9.2.5.2-3 (deactivated SCell), 9.2.5.2-4 (deactivated SCell), 9.2.5.2-8 (deactivated SCG applicable for PSCell) or 9.2.5.2-9 (deactivated SCG applicable for PSCell). When *highSpeedMeasFlag-r16* is configured, T SSB\_measurement\_period\_intra is specified in Table 9.2.5.2-5. When UE *highSpeedMeasFlagFR2-r17* is configured, if SMTC <= 40ms, TSSB\_measurement\_period\_intra is given in Table 9.2.5.2-7; otherwise, T SSB\_measurement\_period\_intra is given in Table 9.2.5.2-2. For power class 6 UE supporting [*measurementEnhancementCAInterFreqFR2-r18*] when [*highSpeedMeasFlagFR2]* is configured, the T SSB\_measurement\_period\_intra given in Table 9.2.5.2-7 (if SMTC <= 40ms) and Table 9.2.5.2-2 (if SMTC > 40ms) shall apply for SCC.

If the higher layer signaling in TS38.331 [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.

If MCG DRX is in use, measurement period requirements for intra-frequency measurement in MCG specified in Table 9.2.5.2-1, Table 9.2.5.2-2, Table 9.2.5.2-3 and Table 9.2.5.2-4 shall depend on the MCG DRX cycle. If SCG DRX is in use, measurement period requirements for intra-frequency measurement in SCG specified in Table 9.2.5.2-1, Table 9.2.5.2-2, Table 9.2.5.2-3, Table 9.2.5.2-4, Table 9.2.5.2-8 and Table 9.2.5.2-9, shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

For FR2, a longer measurement period is allowed, if aperiodic CSI-RS resource is measured for L1-RSRP measurement on any FR2 serving frequency in the same band, and the CSI-RS resource is outside measurement gap and overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols. If *SSB-ToMeasure* or *SS-RSSI-Measurement* is configured, the SSB symbols are indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same band which can be merged and the RSSI symbols are indicated by *SS-RSSI-Measurement*.

Table 9.2.5.2-1: Measurement period for intra-frequency measurements without gaps (FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(200ms, ceil( 5 x Kp) x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil( 5 x Kp ) 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 | |

Table 9.2.5.2-2: Measurement period for intra-frequency measurements without gaps (FR2)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(400ms, ceil(Mmeas\_period\_w/o\_gaps x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5x Mmeas\_period\_w/o\_gaps x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil(Mmeas\_period\_w/o\_gaps xKp 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 | |

Table 9.2.5.2-3: Measurement period for intra-frequency measurements without gaps (deactivated SCell) (FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | Ceil(5 x Kp) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(5 x Kp) x max(measCycleSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(5 x Kp) x max(measCycleSCell, DRX cycle) x CSSFintra |
| NOTE 1: The requirements also apply to deactivated SCG SCel | |

Table 9.2.5.2-4: Measurement period for intra-frequency measurements without gaps (deactivated SCell) (FR2)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | Ceil(Mmeas\_period\_w/o\_gaps x Kp) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(Mmeas\_period\_w/o\_gaps x Kp) x max(measCycleSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(Mmeas\_period\_w/o\_gaps x Kp) x max(measCycleSCell, DRX cycle) x CSSFintra |
| NOTE 1: The requirements also apply to deactivated SCG SCell. | |

Table 9.2.5.2-5: T SSB\_measurement\_period\_intra When *highSpeedMeasFlag-r16* and/or highSpeedMeasCA-Scell-r17 is configured (Frequency range FR1

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX Note 2 | max(200ms, ceil( 5 x Kp) x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 160ms | max(200ms, ceil(5 x M2 Note 2 x Kp) x max(SMTC period,DRX cycle)) x CSSFintra |
| 160ms < DRX cycle≤ 320ms | ceil(4 x M2 Note 2 x Kp) x DRX cycle x CSSFintra |
| DRX cycle>320ms | ceil( Y Note 3 x Kp ) 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: M2 = 1.5 if SMTC period > 40 ms, otherwise M2=1  NOTE 3: Y=3 when SMTC period <= 40ms, Y=5 when SMTC period > 40ms  NOTE 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.  NOTE 5: When highSpeedMeasCA-Scell-r17 is configured, the requirements apply to measurements of secondary component carrier with active SCell. | |

Table 9.2.5.2-6: Measurement period for intra-frequency measurements without gaps (deactivated SCell) (FR1), when highSpeedMeasCA-Scell-r17 is configured

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | ceil( 5 x Kp) x measCycleSCell x CSSFintra |
| DRX cycle≤ 160ms | ceil(5 x Kp) x max(measCycleSCell, M2 Note 1 x DRX cycle) x CSSFintra |
| 160ms < DRX cycle≤ 320ms | ceil(4 x Kp) x max(measCycleSCell, M2 Note 1 x DRX cycle) |
| DRX cycle>320ms | ceil( Y Note 2 x Kp ) x max(measCycleSCell, DRX cycle) x CSSFintra |
| NOTE 1: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1  NOTE 2: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms | |

Table 9.2.5.2-7: Measurement period for intra-frequency measurements without gaps when *highSpeedMeasFlagFR2-r17* is configured (FR2) when SMTC period <= 40ms

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(400ms, ceil(M1Note 2 x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 80ms | max(400ms, ceil(M1Note 2 x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra |
| 80ms< DRX cycle≤ 320ms | ceil(1.5x Mmeas\_period\_w/o\_gaps Note 3 x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle) x CSSFintra |
| DRX cycle>320ms | ceil(Mmeas\_period\_w/o\_gaps Note 3 xKp 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 UE supporting power class 6, M1= 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1= 18 if *highSpeedMeasFlagFR2-r17* = set2 | |

Table 9.2.5.2-8 Measurement period for intra-frequency measurements without gaps (deactivated SCG applicable for PSCell) (FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | Ceil(5 x Kp) x measCyclePSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(5 x Kp) x max(measCyclePSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(5 x Kp) x max(measCyclePSCell, DRX cycle) x CSSFintra |

**Table 9.2.5.2-9: Measurement period for intra-frequency measurements without gaps (deactivated SCG applicable for PSCell) (FR2)**

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | Ceil(Mmeas\_period\_w/o\_gaps x Kp) x measCyclePSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(Mmeas\_period\_w/o\_gaps x Kp) x max(measCyclePSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(Mmeas\_period\_w/o\_gaps x Kp) x max(measCyclePSCell, DRX cycle) x CSSFintra |

Table 9.2.5.2-Y1: Measurement period for intra-frequency measurements without gaps for UE indicating [no gap with interruption] (FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(200ms, 5 x (80ms, SMTC period ))Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5x 5) x [max(80ms, SMTC period,DRX cycle)]) x CSSFintra |
| DRX cycle>320ms | 5 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 | |

Editor’s note: RAN4 has to decide the UE behaviour when DRX is condifured whether interruptions are allowed.

Table 9.2.5.2-Y2: Measurement period for intra-frequency measurements without gaps for UE indicating [no gap with interruption] (FR2)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(400ms, ceil(Mmeas\_period\_w/o\_gaps x Klayer1\_measurement) x (80ms, SMTC period ))Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5x Mmeas\_period\_w/o\_gaps x Klayer1\_measurement) x [max(80, SMTC period,DRX cycle)]) x CSSFintra |
| DRX cycle>320ms | ceil(Mmeas\_period\_w/o\_gaps 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 | |

Editor’s note: RAN4 has to decide the UE behaviour when DRX is condifured whether interruptions are allowed.

Table 9.2.5.2-Y3: T SSB\_measurement\_period\_intra When *highSpeedMeasFlag-r16* and/or highSpeedMeasCA-Scell-r17 is configured (Frequency range FR1, UE indicating [no gap with interruption]

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX Note 2 | max(200ms, 5 x max(80ms,SMTC period))Note 1 x CSSFintra |
| DRX cycle≤ 160ms | max(200ms, ceil(5 x M2 Note 2) x [max(80ms, SMTC period,DRX cycle)]) x CSSFintra |
| 160ms < DRX cycle≤ 320ms | ceil(4 x M2 Note 2) x DRX cycle x CSSFintra |
| DRX cycle>320ms | ceil( Y Note 3) 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: M2 = 1.5 if SMTC period > 40 ms, otherwise M2=1  NOTE 3: Y=3 when SMTC period <= 40ms, Y=5 when SMTC period > 40ms  NOTE 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.  NOTE 5: When highSpeedMeasCA-Scell-r17 is configured, the requirements apply to measurements of secondary component carrier with active SCell. | |

Editor’s note: RAN4 has to decide the UE behaviour when DRX is condifured whether interruptions are allowed.

Table 9.2.5.2-Y4: Measurement period for intra-frequency measurements without gaps when *highSpeedMeasFlagFR2-r17* is configured (FR2) when SMTC period <= 40ms, UE indicating [no gap with interruption]

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(400ms, ceil(M1Note 2 x Klayer1\_measurement) x max(80ms, SMTC period))Note 1 x CSSFintra |
| DRX cycle≤ 80ms | max(400ms, ceil(M1Note 2 x Klayer1\_measurement) x [max(80ms, SMTC period,DRX cycle)]) x CSSFintra |
| 80ms< DRX cycle≤ 320ms | ceil(1.5x Mmeas\_period\_w/o\_gaps Note 3 x Klayer1\_measurement) x max(80ms,SMTC period,DRX cycle) x CSSFintra |
| DRX cycle>320ms | ceil(Mmeas\_period\_w/o\_gaps Note 3 xKp 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 UE supporting power class 6, M1= 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1= 18 if *highSpeedMeasFlagFR2-r17* = set2 | |

Editor’s note: RAN4 has to decide the UE behaviour when DRX is condifured whether interruptions are allowed.

#### 9.2.5.3 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, or the UE indicates [no-gap without interruption] for intra-frequency measurement, or the UE indicates [no-gap with interruption] for intra-frequency measurement. 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 9.2.5.3 also apply when a Pre-MG is deactivated.

For UE supporting concurrent measurement gaps, when concurrent gaps are configured, the requirements in 9.2.5.3 are also applied to the slots that are not interrupted according to requirements in clause 9.1.8.3.

##### 9.2.5.3.1 Scheduling availability of UE performing measurements in TDD bands on FR1

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

- 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.*

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

- 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.*

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 intra-band non-contiguous carrier aggregation is configured for a UE indicating [*intraBandNonColocatedCA-r18*], there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

When TDD inter-band carrier aggregation is performed, 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.

##### 9.2.5.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [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 is expected to 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.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating [*intraBandNonColocatedCA-r18*], there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

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

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

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

- If *deriveSSB-IndexFromCell* is not enabled and the SCS of data and SSB symbols are smaller than 960kHz, 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 *deriveSSB-IndexFromCell* is not enabled and the SCS of data or SSB symbols is 960kHz, the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI SSB symbols to be measured, and on K’ data symbol(s) before each consecutive SSB symbols to be measured and K’ data symbol(s) after each consecutive SSB symbols to be measured within SMTC window duration.

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

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

*-* If *deriveSSB-IndexFromCell* is not enabled and the SCS of data and SSB symbols are smaller than 960kHz, 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 *deriveSSB-IndexFromCell* is not enabled and the SCS of SSB symbols is 960kHz, the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on K’ data symbol(s) before each consecutive SSB to be measured/RSSI symbols and K’ data symbol(s) after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

where

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

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

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

- K=4 for a serving cell with data symbols of 480 kHz SCS and SSB symbols of 120kHz or 480kHz SCS

- K=3 for a serving cell with data symbols of 480 kHz SCS and SSB symbols of 960kHz SCS

- K=7 for a serving cell with data symbols of 960 kHz SCS and SSB symbols of 120kHz or 480kHz SCS

- K=4 for a serving cell with data symbols of 960 kHz SCS and SSB symbols of 960kHz SCS

- K’=[2] for a serving cell with data symbols of 120 kHz SCS and SSB symbols of 960kHz SCS

- K’=[4] for a serving cell with data symbols of 480 kHz SCS and SSB symbols of 960kHz SCS

- K’=[7] for a serving cell with data symbols of 960 kHz SCS and SSB symbols of 960kHz SCS

When intra-band carrier aggregation in FR2 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 aforementioned restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to SS-RSRP, SS-RSRQ or SS-SINR measurement on an FR2 intra-frequency cell in different bands, provided that UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

Note: When inter-band carrier aggregation in FR2 is performed, the scheduling restrictions as defined in clause 9.2.5.3.1 due to a given serving cell also apply to another serving cell in a different FR2 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 FR2 band pair.

If 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

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, the UE is expected to receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, the UE is expected to receive PDSCH that corresponds to the PDCCH that the UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured.

##### 9.2.5.3.4 Scheduling availability of UE performing measurements on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to measurements performed on FR2 serving cell frequency layer. However, the scheduling restrictions as defined in clause 9.2.5.3.1 due to a given serving cell in FR2 also apply to another serving cell in an FR1 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 FR1-FR2 band pair.

There are no scheduling restrictions on FR2 serving cell(s) due to measurements performed on FR1 serving cell frequency layer. However, the scheduling restrictions as defined in clause 9.2.5.3.1 due to a given serving cell in FR1 also apply to another serving cell in an FR2 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 FR1-FR2 band pair.

#### 9.2.5.4 SFTD Measurements between PCell and PSCell

##### 9.2.5.4.1 Introduction

This clause contains SFTD measurement requirements for UE which supports NR-DC and is configured with a PSCell in RRC\_CONNECTED state. The UE shall perform SFTD measurement between PCell and PSCell, and report the SFTD result with/without SS-RSRP after the network requests with *reportType* for the associated *reportConfig* set to *reportSFTD*. The overall delay includes RRC procedure delay defined in clause 12 in TS 38.331 [2], and SFTD measurement reporting delay in clause 9.2.5.4.3..

##### 9.2.5.4.2 SFTD Measurement delay

When no DRX is used in either of PCell and PSCell, the physical layer measurement period of the SFTD measurement shall be Tmeasure\_SFTD1 = max(200, 5 x SMTC period) ms, where the SMTC period refers to the maximum between the configured SMTC period in PCell and PSCell.

When DRX is used in either of the PCell or the PSCell, or in both PCell and PSCell, the physical layer measurement period (Tmeasure\_SFTD1) of the SFTD measurement shall be as specified in Table 9.2.5.4.2-1.

Table 9.2.5.4.2-1: SFTD measurement requirement when DRX is used

|  |  |
| --- | --- |
| DRX cycle length (s) Note 3 | Tmeasure\_SFTD1 (s) |
| ≤0.04 | max(0.2, 5 x SMTC period) (Note2) |
| 0.04<DRX cycle≤0.32 | 8 x max(DRX cycle, SMTC period) |
| 0.32<DRX cycle≤10.24 | 5 x DRX cycle |
| Note 1: SMTC period in this table refers to the maximum between the configured SMTC period in PCell and PSCell.  Note 2: Number of DRX cycles depends upon the DRX cycle in use  Note 3: DRX cycle length in this table refers to the DRX cycle length configured for PCell or PSCell. When DRX is used in both PCell and PSCell, DRX cycle length in this table refers to the longer of the DRX cycle lengths for PCell and PSCell. | |

If PSCell is changed without changing carrier frequency of PSCell, while the UE is performing SFTD measurements, the UE shall still meet SFTD measurement and accuracy requirements for the new PSCell. In this case the UE shall restart the SFTD measurement, and the total physical layer measurement period shall not exceed Tmeasure\_SFTD2 as defined by the following expression:

Tmeasure\_SFTD2 = (M+1)\*(Tmeasure\_SFTD1) + M\*TPSCell\_change\_NRDC

where:

M is the number of times the NR PSCell is changed over the measurement period (Tmeasure\_SFTD2), and

TPSCell\_change\_NRDC is the time necessary to change the PSCell; it can be up to 25ms.

If PCell is changed, or if PSCell is changed with different carrier frequency from PSCell, the UE shall terminate SFTD measurements.

The measurement accuracy for the SFTD measurement when DRX is used as well as when no DRX is used shall be as specified in the clause 10.1.21.

##### 9.2.5.4.3 SFTD Measurement Reporting Delay

The SFTD measurement reporting delay is defined as the time between a command that will trigger an SFTD 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 any delay caused by no UL resources available for UE to send the measurement report.

The SFTD measurement reporting delay shall be less than measurement period defined in clause 9.2.5.4.2 plus the RRC procedure delay defined in TS 38.331 [2].

### 9.2.6 Intra-frequency measurements with measurement gaps

#### 9.2.6.1 Void

#### 9.2.6.2 Intra-frequency cell identification

When a measurement gap is provided or an activated Pre-MG is provided without any pre-MG status changed during the measurement period, the UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_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 the UE has been 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. It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2 with SCS smaller or equal to 480 kHz.

Tidentify\_intra\_without\_index = TPSS/SSS\_sync\_intra + T SSB\_measurement\_period\_intra ms

Tidentify\_intra\_with\_index = TPSS/SSS\_sync\_ntra + T SSB\_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 9.2.6.2-1, 9.2.6.2-2 or 9.2.6.2-9.

- For UE supporting power class 6 with *highSpeedMeasFlagFR2-r17* configured, if SMTC <= 40ms, TPSS/SSS\_sync\_intra is given in Table 9.2.6.2-9; otherwise, TPSS/SSS\_sync\_intra is given in Table 9.2.6.2-2.

TSSB\_time\_index\_intra: it is the time period used to acquire the index of the SSB being measured given in table 9.2.6.2-3 or 9.2.6.2-10 (for FR2-2).

T SSB\_measurement\_period\_intra: equal to a measurement period of SSB based measurement given in table 9.2.6.3-1 or 9.2.6.3-2.

- For UE supporting power class 6 with *highSpeedMeasFlagFR2-r17* configured, if SMTC <= 40ms, TSSB\_measurement\_period\_intra is given in Table 9.2.6.3-4; otherwise, T SSB\_measurement\_period\_intra is given in Table 9.2.6.3-2.

- For power class 6 UE supporting [*measurementEnhancementCAInterFreqFR2-r18*] when [*highSpeedMeasFlagFR2]* is configured, the T SSB\_measurement\_period\_intra given in Table 9.2.6.3-4 (if SMTC <= 40ms) and Table 9.2.6.3-2 (if SMTC > 40ms) shall apply for SCC.

CSSFintra: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps.

Kgap is the scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. Kgap = 1 when the UE is not configured with concurrent measurement GAPs. Otherwise, Kgap = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

For a window W of duration max(SMTC period, xRP\_max), where xRP max is the maximum xRP across all configured per-UE measurement GAPs and per-FR measurement GAPs within the same FR as the SSB frequency layer, and starting from the beginning of any SMTC occasion:

-- Ntotal is the total number of SMTC occasions that are covered by instances of the associated measurement gap within the window W, including those overlapped with other GAP occasions within the window, and

- Navailable is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W after accounting for GAP collisions by applying the GAP collision rule in section 9.1.8.3.

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

When concurrent measurement GAPs are configured, requirements in this clause do not apply if Navailable =0.

Mpss/sss\_sync\_with\_gaps : For a UE supporting FR2-1 power class 1 or 5, Mpss/sss\_sync with\_gaps=40. For a UE supporting FR2-1 power class 2, Mpss/sss\_sync with\_gaps =24. For a UE supporting FR2-1 power class 3, Mpss/sss\_sync with\_gaps =24. For a UE supporting FR2-1 power class 4, Mpss/sss\_sync with\_gaps =24. For a UE supporting FR2-2 power class 1, Mpss/sss\_sync with\_gaps = 60. For a UE supporting FR2-2 power class 2, Mpss/sss\_sync with\_gaps = 36. For a UE supporting FR2-2 power class 3, Mpss/sss\_sync with\_gaps = 36.

Mmeas\_period\_ with\_gaps: For a UE supporting FR2-1 power class 1 or 5, Mmeas\_period\_ with\_gaps =40. For a UE supporting FR2-1 power class 2, Mmeas\_period\_ with\_gaps =24. For a UE supporting FR2-1 power class 3, Mmeas\_period\_ with\_gaps =24. For a UE supporting FR2-1 power class 4, Mmeas\_period with\_gaps =24. For a UE supporting FR2-2 power class 1, Mmeas\_period\_ with\_gaps = 60. For a UE supporting FR2-2 power class 2, Mmeas\_period\_ with\_gaps = 36. For a UE supporting FR2-2 power class 3, Mmeas\_period\_ with\_gaps = 36.

- MSSB\_index\_intra: For a UE supporting FR2-2 power class 1, MSSB\_index\_intra = 72. For a UE supporting FR2-2 power class 2, MSSB\_index\_intra = 48. For a UE supporting FR2 power class 3, MSSB\_index\_intra = 48.

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, requirements are not specified for Tidentify\_intra\_without\_index or Tidentify\_intra\_with\_index.

If MCG DRX is in use, cell identification requirements for intra-frequency measurement in MCG specified in Table 9.2.6.2-1, Table 9.2.6.2-2, and Table 9.2.6.2-3 shall depend on the MCG DRX cycle. If SCG DRX is in use, cell identification requirements for intra-frequency measurement in SCG specified in Table 9.2.6.2-1, Table 9.2.6.2-2, and Table 9.2.6.2-3 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 9.2.6.2-1: Time period for PSS/SSS detection (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, 5 x Kgap x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(600ms, ceil(M2Note 1x 5 x Kgap) x max(MGRP, SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | Ceil( 5 x Kgap ) x max(MGRP, DRX cycle) x CSSFintra |
| NOTE 1: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.  NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.  NOTE 3: For a UE supporting concurrent measurement GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer.  NOTE 4: When highSpeedMeasCA-Scell-r17 is configured, the requirements apply to UE on measurements of secondary component carrier with active SCell. | |

**Table 9.2.6.2-2: Time period for PSS/SSS detection (FR2)**

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, Mpss/sss\_sync\_with\_gaps x KFR x Kgap x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(600ms, ceil(1.5x Mpss/sss\_sync\_with\_gaps x KFR x Kgap) x max(MGRP, SMTC period, DRX cycle))x CSSFintra |
| DRX cycle>320ms | Ceil( Mpss/sss\_sync\_with\_gaps x KFR x Kgap ) x max(MGRP, DRX cycle) x CSSFintra |
| NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer.  NOTE 2: KFR is a scaling factor depending on the frequency range and the SSB SCS. For FR2-1, KFR = 1. For FR2-2: KFR = 1 if the SCS of the SSB of the cell being detected is 120 kHz, KFR = 2 if the SCS of the SSB of the cell being detected is 480 kHz, and KFR = 3 if the SCS of the SSB of the cell being detected is 960 kHz. | |

Table 9.2.6.2-3: Time period for time index detection (Frequency range FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(120ms, ceil(3 x Kgap ) x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(120ms, ceil(M2Note 1x 3 x Kgap) x max(MGRP, SMTC period,DRX cycle) x CSSFintra) |
| DRX cycle>320ms | Ceil(3 x Kgap )x max(MGRP, DRX cycle) x CSSFintra |
| NOTE 1: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.  NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.  NOTE 3: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer.  NOTE 4: When highSpeedMeasCA-Scell-r17 is configured, the requirements apply to UE on measurements of secondary component carrier with active SCell. | |

Table 9.2.6.2-7: Void

Table 9.2.6.2-8: Void

Table 9.2.6.2-8: Void

Table 9.2.6.2-9: Time period for PSS/SSS detection when *highSpeedMeasFlagFR2-r17* is configured, (FR2) when SMTC period <=40ms

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, M1Note 2 x Kgap x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 80ms | max(600ms, ceil(M1Note2 x Kgap) x max(MGRP, SMTC period, DRX cycle))x CSSFintra |
| 80ms< DRX cycle≤ 320ms | max(600ms, ceil(Mpss/sss\_sync\_with\_gaps x Kgap) x max(MGRP, SMTC period, DRX cycle))x CSSFintra |
| DRX cycle>320ms | Ceil( Mpss/sss\_sync\_with\_gaps x Kgap ) x max(MGRP, DRX cycle) x CSSFintra |
| NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer.  NOTE 2: For UE supporting power class 6, M1= 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1= 18 if *highSpeedMeasFlagFR2-r17* = set2  NOTE 3: Void | |

Table 9.2.6.2-10: Time period for time index detection (Frequency range FR2-2)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(200ms, ceil(MSSB\_index\_intra x Kgap x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5 x MSSB\_index\_intra x Kgap) x max(MGRP, SMTC period, DRX cycle) x CSSFintra) |
| DRX cycle>320ms | Ceil(MSSB\_index\_intra x Kgap)x DRX cycle x CSSFintra |

Table 9.2.6.2-11: Time period for time index detection (Frequency range FR1) for less\_than\_5Mhz UE

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra\_less\_than\_5Mhz |
| No DRX | max(120ms, [X] x max(MGRP, SMTC period)) x CSSFintra\_less\_than\_5Mhz |
| DRX cycle≤ 320ms | max(120ms, ceil(1.5 x [Y]) x max(MGRP, SMTC period,DRX cycle) x CSSFintra\_less\_than\_5Mhz) |
| DRX cycle>320ms | [Z] x max(MGRP, DRX cycle) x CSSFintra\_less\_than\_5Mhz |
| Editor’s note: Y values will be updated based on simulations for 12, 15 and 20 PRB | |

#### 9.2.6.3 Intrafrequency Measurement Period

The requirements in this clause apply when a measurement gap is provided or when an activated Pre-MG is provided without any pre-MG status changed during the measurement period.

The measurement period for FR1 intrafrequency measurements with gaps is as shown in table 9.2.6.3-1.

The measurement period for FR2 intrafrequency measurements with gaps is as shown in table 9.2.6.3-2.

When *highSpeedMeasFlag-r16* is configured, T SSB\_measurement\_period\_intra is specified in Table 9.2.6.3-3.

For UE supporting power class 6 with *highSpeedMeasFlagFR2-r17* configured, if SMTC <= 40ms, TSSB\_measurement\_period\_intra is given in Table 9.2.6.3-4; otherwise, T SSB\_measurement\_period\_intra is given in Table 9.2.6.3-2.

For power class 6 UE supporting [*measurementEnhancementCAInterFreqFR2-r18*] when [*highSpeedMeasFlagFR2]* is configured, the T SSB\_measurement\_period\_intra given in Table 9.2.6.3-4 (if SMTC <= 40ms) and Table 9.2.6.3-2 (if SMTC > 40ms) shall apply for SCC.

If MCG DRX is in use, measurement period requirements for intra-frequency measurement in MCG specified in Table 9.2.6.3-1 and Table 9.2.6.3-2, shall depend on the MCG DRX cycle. If SCG DRX is in use, measurement period requirements for intra-frequency measurement in SCG specified in Table 9.2.6.3-1and Table 9.2.6.3-2, shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

For either an FR1 or FR2 serving cell, longer measurement period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

Table 9.2.6.3-1: Measurement period for intra-frequency measurements with gaps(FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(200ms, ceil(5 x Kgap )x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5x 5 x Kgap) x max(MGRP, SMTC period,DRX cycle))x CSSFintra |
| DRX cycle>320ms | Ceil(5 x Kgap ) x max(MGRP, DRX cycle) x CSSFintra |
| NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer. | |

Table 9.2.6.3-2: Measurement period for intra-frequency measurements with gaps(FR2)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(400ms, ceil(Mmeas\_period with\_gaps x Kgap ) x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5 x Mmeas\_period with\_gaps x Kgap) x max(MGRP, SMTC period, DRX cycle)) Note 1 x CSSFintra |
| DRX cycle>320ms | Ceil( Mmeas\_period with\_gaps x Kgap ) x max(MGRP, DRX cycle) x CSSFintra |
| NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer. | |

Table 9.2.6.3-3: Measurement period When *highSpeedMeasFlag-r16* is configured (Frequency Range FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(200ms, ceil( 5 x Kgap ) x max(MGRP, SMTC period)) Note 1 x CSSFintra |
| DRX cycle≤ 160ms | max(200ms, ceil(M2Note 2 x 5 x Kgap) x max(MGRP, SMTC period,DRX cycle)) x CSSFintra |
| 160ms < DRX cycle≤ 320ms | max(200ms, ceil(M2Note 2 x 4 x Kgap) x max(MGRP, DRX cycle)) x CSSFintra |
| DRX cycle>320ms | Ceil(Y Note 3 x Kgap ) x max(MGRP, 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: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1  NOTE 3: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms  NOTE 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.  NOTE 5: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer.  NOTE 6: When highSpeedMeasCA-Scell-r17 is configured, the requirements also apply to UE on measurements of secondary component carrier with active SCell. | |

Table 9.2.6.3-4: Measurement period for intra-frequency measurements with gaps when *highSpeedMeasFlagFR2-r17* is configured (FR2) when SMTC period<=40ms

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(400ms, ceil(M1Note 2 x Kgap ) x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 80ms | max(400ms, ceil(M1Note 2 x Kgap) x max(MGRP, SMTC period, DRX cycle)) Note 1 x CSSFintra |
| 80ms< DRX cycle≤ 320ms | max(400ms, ceil(Mmeas\_period with\_gaps x Kgap) x max(MGRP, SMTC period, DRX cycle)) Note 1 x CSSFintra |
| DRX cycle>320ms | Ceil( Mmeas\_period with\_gaps x Kgap ) x max(MGRP, DRX cycle) x CSSFintra |
| NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer.  NOTE 2: For UE supporting power class 6, M1= 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1= 18 if *highSpeedMeasFlagFR2-r17* = set2  NOTE 3: Void | |

### 9.2.7 Intra-frequency measurements with NCSG

#### 9.2.7.1 Intra-frequency cell identification

For the UE supporting NCSG, if NCSG is provided, the UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_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 the UE has been 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. It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.

Tidentify\_intra\_without\_index = TPSS/SSS\_sync\_intra + T SSB\_measurement\_period\_intra ms

Tidentify\_intra\_with\_index = TPSS/SSS\_sync\_ntra + T SSB\_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 9.2.7.1-1, 9.2.7.1-2, 9.2.7.1-4 (deactivated Scell) or 9.2.7.1-5 (deactivated Scell).

TSSB\_time\_index\_intra: it is the time period used to acquire the index of the SSB being measured given in table 9.2.7.1-3 or 9.2.7.1-6 (deactivated Scell).

T SSB\_measurement\_period\_intra: equal to a measurement period of SSB based measurement given in table 9.2.7.2-1, 9.2.7.2-2, 9.2.7.2-3, 9.2.7.2-4 (deactivated Scell) or 9.2.7.2-5 (deactivated Scell).

CSSFintra: it is a carrier specific scaling factor and is determined according to CSSFwithin\_ncsg,i in clause 9.1.5.3 for measurement conducted within NCSG.

KNCSG is the scaling factor for a SSB frequency layer to be measured within an associated NCSG pattern. KNCSG = 1 when the UE is not configured with concurrent measurement GAPs. Otherwise, KNCSG = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

For a window W of duration max(SMTC period, xRP\_max), where xRP max is the maximum xRP across all configured per-UE GAP and per-FR GAP within the same FR as the SSB frequency layer, and starting from the beginning of any SMTC occasion:

-- Ntotal is the total number of SMTC occasions that are covered by instances of the associated NCSG within the window W, including those overlapped with other GAP occasions within the window, and

-- Navailable is the number of SMTC occasions that are covered by instances of the non-dropped associated NCSG within the window W after accounting for GAP collisions by applying the GAP collision rule in section 9.1.8.3.

-- xRP = MGRP when configured GAP is MG, and xRP = VIRP when configured GAP is NCSG.

When concurrent measurement GAPs are configured, requirements in this clause do not apply if Navailable =0.

Mpss/sss\_sync\_with\_gaps : For a UE supporting FR2 power class 1 or 5, Mpss/sss\_sync with\_gaps=40. For a UE supporting FR2 power class 2, Mpss/sss\_sync with\_gaps =24. For a UE supporting FR2 power class 3, Mpss/sss\_sync with\_gaps =24. For a UE supporting power class 4, Mpss/sss\_sync with\_gaps =24

Mmeas\_period\_ with\_gaps: For a UE supporting power class 1 or 5, Mmeas\_period\_ with\_gaps =40. For a UE supporting power class 2, Mmeas\_period\_ with\_gaps =24. For a UE supporting power class 3, Mmeas\_period\_ with\_gaps =24. For a UE supporting power class 4, Mmeas\_period with\_gaps =24.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and smtc1 is fully overlapping with NCSG and smtc2 is partially overlapping with NCSG, requirements are not specified for Tidentify\_intra\_without\_index or Tidentify\_intra\_with\_index.

Table 9.2.7.1-1: Time period for PSS/SSS detection with NCSG (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, 5 x KNCSG x max(VIRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(600ms, ceil(M2Note 1x 5 x KNCSG) x max(VIRP, SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | 5 x KNCSG x max(VIRP, DRX cycle) x CSSFintra |
| NOTE 1: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.  NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell. | |

**Table 9.2.7.1-2: Time period for PSS/SSS detection with NCSG (FR2)**

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, Mpss/sss\_sync\_with\_gaps x KNCSG x max(VIRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(600ms, ceil(1.5x Mpss/sss\_sync\_with\_gaps x KNCSG) x max(VIRP, SMTC period, DRX cycle))x CSSFintra |
| DRX cycle>320ms | Mpss/sss\_sync\_with\_gaps x KNCSG x max(VIRP, DRX cycle) x CSSFintra |

Table 9.2.7.1-3: Time period for time index detection with NCSG (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(120ms, 3 x KNCSG x max(VIRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(120ms, ceil(M2Note 1x 3 x KNCSG) x max(VIRP, SMTC period,DRX cycle) x CSSFintra) |
| DRX cycle>320ms | 3 x KNCSG x max(VIRP, DRX cycle) x CSSFintra |
| NOTE 1: *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.  NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell. | |

Table 9.2.7.1-4: Time period for PSS/SSS detection with NCSG (deactivated SCell) (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | 5 x KNCSG x max(measCycleSCell, VIRP) x CSSFintra |
| DRX cycle≤ 320ms | 5 x KNCSG x max(measCycleSCell, VIRP, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | 5 x KNCSG x max(measCycleSCell, VIRP, DRX cycle) x CSSFintra |

**Table 9.2.7.1-5: Time period for PSS/SSS detection with NCSG (deactivated SCell) (FR2)**

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | Mpss/sss\_with\_ncsg x KNCSG x max(measCycleSCell, VIRP) x CSSFintra |
| DRX cycle≤ 320ms | Mpss/sss\_with\_ncsg x KNCSG x max(measCycleSCell, VIRP, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Mpss/sss\_with\_ncsg x KNCSG x max(measCycleSCell, VIRP, DRX cycle) x CSSFintra |

Table 9.2.7.1-6: Time period for time index detection with NCSG (deactivated SCell) (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | 3 x KNCSG x max(measCycleSCell, VIRP) x CSSFintra |
| DRX cycle≤ 320ms | 3 x KNCSG x max(measCycleSCell, VIRP, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | 3 x KNCSG x max(measCycleSCell, VIRP,DRX cycle) x CSSFintra |

#### 9.2.7.2 Measurement period

When *highSpeedMeasFlag-r16* is configured, the measurement period with NCSG is specified in Table 9.2.7.2-3.

For either an FR1 or FR2 serving cell, longer measurement period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

Table 9.2.7.2-1: Measurement period for intra-frequency measurements with NCSG (FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(200ms, 5 x KNCSG x max(VIRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5x 5 x KNCSG) x max(VIRP, SMTC period,DRX cycle))x CSSFintra |
| DRX cycle>320ms | 5 x KNCSG x max(VIRP, DRX cycle) x CSSFintra |

Table 9.2.7.2-2: Measurement period for intra-frequency measurements with NCSG (FR2)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(400ms, Mmeas\_period with\_gaps x KNCSG x max(VIRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5 x Mmeas\_period with\_gaps x KNCSG) x max(VIRP, SMTC period, DRX cycle)) Note 1 x CSSFintra |
| DRX cycle>320ms | Mmeas\_period with\_gaps x KNCSG x max(VIRP, DRX cycle) x CSSFintra |

Table 9.2.7.2-3: Measurement period with NCSG When *highSpeedMeasFlag-r16* is configured (FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(200ms, 5 x KNCSG x max(VIRP, SMTC period)) Note 1 x CSSFintra |
| DRX cycle≤ 160ms | max(200ms, ceil(M2Note 2 x 5 x KNCSG) x max(VIRP, SMTC period,DRX cycle)) x CSSFintra |
| 160ms < DRX cycle≤ 320ms | max(200ms, ceil(M2Note 2 x 4 x KNCSG) x max(VIRP, DRX cycle)) x CSSFintra |
| DRX cycle>320ms | Y Note 3 x KNCSG x max(VIRP, 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: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1  NOTE 3: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms  NOTE 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell. | |

**Table 9.2.7.2-4: Measurement period for intra-frequency measurements with NCSG (deactivated SCell) (FR1)**

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | 5 x KNCSG x max(measCycleSCell, VIRP) x CSSFintra |
| DRX cycle≤ 320ms | 5 x KNCSG x max(measCycleSCell, VIRP, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | 5 x KNCSG x max(measCycleSCell, VIRP, DRX cycle) x CSSFintra |

**Table 9.2.7.2-5: Measurement period for intra-frequency measurements with NCSG (deactivated SCell) (FR2)**

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | Mmeas\_period with\_gaps x KNCSG x max(measCycleSCell, VIRP) x CSSFintra |
| DRX cycle≤ 320ms | Mmeas\_period with\_gaps x KNCSG x max(measCycleSCell, VIRP, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Mmeas\_period with\_gaps x KNCSG x max(measCycleSCell, VIRP, DRX cycle) x CSSFintra |

Note: Requirements for measurement on deactivated SCC in this clause do not apply if SMTC on the deactivated SCC is fully non-overlapped with NCSG, and the requirements for measurement on deactivated SCC specified in clause 9.2.5 apply.

#### 9.2.7.3 Scheduling availability during intra-frequency measurement with NCSG

Scheduling availability specified in 9.2.5.3 applies to scheduling availability during intra-frequency measurement with NCSG.

**------------END OF CHANGE 17: 9.2.5/6/7 [R4-2317292/8] -----------**

**------- START OF CHANGE 18: 9.3.1/4/5/9/10 [R4-2317301/292] -------**

## 9.3 NR inter-frequency measurements

### 9.3.1 Introduction

A measurement is defined as an SSB based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.2.

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

A measurement is defined as an inter-frequency SSB based measurements without measurement gaps (either legacy measurement gap or NCSG) in active BWP, for UE capable of *interFrequencyMeas-NoGap* provided that

- the UE supports *interFrequencyMeas-Nogap-r16* [15], and

- the SSB is completely contained in the active BWP of the UE.

- For inter-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.3.9.3.

- Note: Non-CA capable UE is not expected to indicate support of *interFrequencyMeas-Nogap-r16* [15].

Besides the conditions listed above,

- for UE supporting *nr-NeedForGapNCSG-reporting-r17* and indicating *NeedForGapNCSG-InfoNR* for inter-frequency measurement,

- An inter-frequency SSB measurement is defined as measurement without gap if

- the UE indicates ‘nogap-noncsg’ via *NeedForGapNCSG-InfoNR* for the inter-frequency measurement, and

- the SSB is not completely contained in the active BWP of the UE

- For inter-frequency SSB based measurements without MG and NCSG, UE may cause scheduling restriction as specified in clause 9.3.9.4.

- An inter-frequency SSB measurement is defined as measurement with NCSG if

- the UE indicates ‘ncsg’ via *NeedForGapNCSG-InfoNR* for the inter-frequency measurement, and

- the SSB is not completely contained in the active BWP of the UE

- For inter-frequency SSB based measurements with NCSG, UE may cause scheduling restriction as specified in clause 9.3.10.3.

- An inter-frequency SSB measurement is defined as measurement with gap if

- the UE indicates ‘gap’ via *NeedForGapNCSG-InfoNR* for the inter-frequency measurement, and

- the SSB is not completely contained in the active BWP of the UE

- for UE supporting [*NeedForGap-InfoNR-R18*] for inter-frequency measurement,

- An inter-frequency SSB measurement is defined as measurement without gap if

- the UE indicates ‘no-gap’ via *NeedForGap-InfoNR* and the UE indicates ‘[*nogap-nointerruption*]’ or [*nogap-intrruption*] via [*NeedForGap-InfoNR-R18]* for the inter-frequency measurement

- the SSB is not completely contained in the active BWP of the UE

When UE indicate [no-gap-with-interruption], the interruption requirement during inter-frequency measurement without gap is defined in [clause 8.2.2.2.X]. No interruption is allowed for UE during inter-frequency measurement without gap when

- the UE indicates [no-gap-no-interruption], or

- inter-frequency SMTC is partially or fully overlapping with measurement gaps for UE indicating [no-gap-with-interruption, or

- the SSB is completely contained in the active BWP of the UE.

During inter-frequency SSB based measurements without gap, UE may cause scheduling restriction as specified in clause 9.3.9.4.

- An inter-frequency SSB measurement is defined as measurement with gap if

- the UE indicates ‘gap’ via *NeedForGap-InfoNR* for the inter-frequency measurement.

SSB based measurements are configured along with a measurement timing configuration (SMTC) per carrier, which provides periodicity, duration and offset information on a window of up to 5ms where the measurements on the configured inter-frequency carrier are to be performed. For inter-frequency connected mode measurements, one measurement window periodicity may be configured per inter-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB and measure RSSI of RSRQ on an inter-frequency measurement object which start earlier than the gap starting time + switching time, nor detect SSB and measure RSSI of RSRQ which ends later than the gap end – switching time. When the inter-frequency cells are in FR2 and the per-FR gap is configured to the UE in EN-DC, SA NR, NE-DC and NR-DC, or the serving cells are in FR2, the inter-frequency cells are in FR2 and the per-UE gap is configured to the UE in SA NR and NR-DC, the switching time is 0.25ms. Otherwise the switching time is 0.5ms.

The requirements in this clause shall also apply, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

Longer measurement period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

The inter-frequency measurement requirements in clause 9.3.4 and clause 9.3.5 applies for the following scenarios:

- SSB-based inter-frequency measurement object with measurement gap.

- SSB-based inter-frequency measurement object without measurement gap for UE capable of *interFrequencyMeas-NoGap*, when

- all of the SMTC occasions of this inter-frequency measurement object are overlapped with the measurement gap or associated measurement gap in concurrent measurement gaps, or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this inter-frequency measurement object are overlapped with the union of concurrent measurement gaps, or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or associated measurement gap in concurrent measurement gaps and the flag *interFrequencyConfig-NoGap-r16* is not configured by the Network.

- SSB-based inter-frequency measurement object without measurement gap for UE capable of [*NeedForInterruptionNR-r18*], when

- all of the SMTC occasions of this inter-frequency measurement object are overlapped with the measurement gap or associated measurement gap in concurrent measurement gaps for the UE indicates ‘no-gap’ via *NeedForGap-InfoNR* for the inter-frequency measurement and [no-gap-with-interruption] or [no-gap-no-interruption], or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped with the measurement gap or associated measurement gap in concurrent measurement gaps for the UE indicates ‘no-gap’ via *NeedForGap-InfoNR* for the inter-frequency measurement.

The inter-frequency measurement requirements in clause 9.3.9 applies for the following scenarios:

- SSB-based inter-frequency measurement with no measurement gap, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps, 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, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- for UE capable of [*NeedForInterruptionNR-r18*], when

- none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps for the UE indicates ‘no-gap’ via *NeedForGap-InfoNR* for the inter-frequency measurement and [no-gap-with-interruption] or [no-gap-no-interruption].

- part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps, for the UE indicates ‘no-gap’ via *NeedForGap-InfoNR* for the inter-frequency measurement.

The inter-frequency measurement requirements in clause 9.3.10 applies for the following scenarios:

- SSB-based inter-frequency measurement object without measurement gap, when all of the SMTC occasions of this inter-frequency measurement object are overlapped by the NCSG;

- SSB-based inter-frequency measurement object with NCSG.

### 9.3.2 Requirements applicability

The requirements in clause 9.3 apply, provided:

- The cell being identified or measured is detectable.

An inter-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clauses 10.1.4 and 10.1.5 for FR1 and FR2, respectively, for a corresponding Band,

- SS-RSRQ related side conditions given in clauses 10.1.9 and 10.1.10 for FR1 and FR2, respectively, for a corresponding Band,

- SS-SINR related side conditions given in clauses 10.1.14 and 10.1.15 for FR1 and FR2, respectively, for a corresponding Band,

- SSB\_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding Band.

#### 9.3.2.1 Void

#### 9.3.2.2 Void

### 9.3.3 Number of cells and number of SSB

#### 9.3.3.1 Requirements for FR1

For each inter-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:

- 4 identified cells, and

- 7 SSBs with different SSB index and/or PCI on the inter-frequency layer.

#### 9.3.3.2 Requirements for FR2

For each inter-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:

- 4 identified cells, and

- 10 SSBs with different SSB index and/or PCI on the inter-frequency layer, and

- 1 SSB per identified cell.

### 9.3.4 Inter-frequency measurement with measurement gaps

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE 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 FR2-1 target frequency layers and 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 + T SSB\_measurement\_period\_inter) ms

Tidentify\_inter\_with\_index = (TPSS/SSS\_sync\_inter + T SSB\_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 9.3.4-1, table 9.3.4-2, table 9.3.4-5 when *highSpeedMeasInterFreq-r17* is configured and UE supports measurementEnhancementInterFreq-r17 and table 9.3.4-9 when *highSpeedMeasFlagFR2-r17* is configured and UE supports [*measurementEnhancementCAInterFreqFR2-r18*]. When the SCG is deactivated, table 9.3.4-7 applies for an inter-frequency carrier configured by SCG and not configured by MCG and table 9.3.4-2 applies for an inter-frequency carrier configured by both SCG and MCG. Regardless of whether the SCG is activated or deactivated, table 9.3.4-2 applies for an inter-frequency carrier configured only by MCG.

- For UE supporting power class 6 and [*measurementEnhancementCAInterFreqFR2-r18*] with *highSpeedMeasFlagFR2-r17* configured, if SMTC <= 40ms, TPSS/SSS\_sync\_inter is given in Table 9.3.4-9; otherwise, TPSS/SSS\_sync\_inter is given in Table 9.3.4-2.

TSSB\_time\_index\_inter: it is the time period used to acquire the index of the SSB being measured given in table 9.3.4-3,table 9.3.4-6 when *highSpeedMeasInterFreq* is configured and UE supports measurementEnhancementInterFreq-r17, and table 9.3.4-10 when *highSpeedMeasFlagFR2-r17* is configured and UE supports [*measurementEnhancementCAInterFreqFR2-r18*]. When the SCG is deactivated, table 9.3.4-8 applies for an inter-frequency carrier configured by SCG and not configured by MCG and table 9.3.4-4 applies for an inter-frequency carrier configured by both SCG and MCG. Regardless of whether the SCG is activated or deactivated, table 9.3.4-4 applies for an inter-frequency carrier configured only by MCG.

- For UE supporting power class 6 and [*highSpeedFR2measurementEnhancementInterFreq-r18*] with *highSpeedMeasFlagFR2-r17* configured, if SMTC <= 40ms, TSSB\_measurement\_period\_inter is given in Table 9.3.5-5; otherwise, TSSB\_measurement\_period\_inter is given in Table 9.3.5-2.

TSSB\_measurement\_period\_inter: equal to a measurement period of SSB based measurement given in table 9.3.5-1, table 9.3.5-2, table 9.3.5-3 when *highSpeedMeasInterFreq* is configured and UE supports measurementEnhancementInterFreq-r17, and in table 9.3.5-5 when *highSpeedMeasFlagFR2-r17* is configured and UE supports [*measurementEnhancementCAInterFreqFR2-r18*]. When the SCG is deactivated, table 9.3.5-4 applies for an inter-frequency carrier configured by SCG and not configured by MCG and table 9.3.5-2 applies for an inter-frequency carrier configured by both SCG and MCG. Regardless of whether the SCG is activated or deactivated, table 9.3.5-2 applies for an inter-frequency carrier configured only by MCG.

- For UE supporting power class 6 and [*measurementEnhancementCAInterFreqFR2-r18*] with *highSpeedMeasFlagFR2-r17* configured, TSSB\_measurement\_period\_inter is given in Table 9.3.5-5; otherwise, TSSB\_measurement\_period\_inter is given in Table 9.3.5-2.

Mpss/sss\_sync\_inter: For a UE supporting FR2-1 power class 1 or 5, Mpss/sss\_sync\_inter = 64 samples. For a UE supporting FR2-1 power class 2, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2-1 power class 3, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2-1 power class 4, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2-2 power class 1, Mpss/sss\_sync\_inter = 96. For a UE supporting FR2-2 power class 2, Mpss/sss\_sync\_inter = 60. For a UE supporting FR2-2 power class 3, Mpss/sss\_sync\_inter = 60.

MSSB\_index\_inter: For a UE supporting FR2-1 power class 1 or 5, MSSB\_index\_inter = 40 samples. For a UE supporting FR2 power class 2, MSSB\_index\_inter = 24 samples. For a UE supporting FR2-1 power class 3, MSSB\_index\_inter = 24 samples. For a UE supporting FR2-1 power class 4, MSSB\_index\_inter = 24 samples. For a UE supporting FR2-2 power class 2 or 3, MSSB\_index\_inter = 48 samples. For a UE supporting FR2 power class 1, MSSB\_index\_inter = 72 samples.

Mmeas\_period\_inter: For a UE supporting FR2-1 power class 1 or 5, Mmeas\_period\_inter =64. For a UE supporting FR2-1 power class 2, Mmeas\_period\_inter=40. For a UE supporting FR2-1 power class 3, Mmeas\_period\_inter =40. For a UE supporting FR2-1 power class 4, Mmeas\_period\_inter = 40. For a UE supporting FR2-2 power class 1, Mmeas\_period\_inter = 96. For a UE supporting FR2-2 power class 2, Mmeas\_period\_inter = 60. For a UE supporting FR2-2 power class 3, Mmeas\_period\_inter = 60.

CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps.

Kgap is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. Kgap = 1 when the UE is not configured with concurrent measurement GAPs. Otherwise, Kgap = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

- For a window W of duration max(SMTC period, xRP\_max), where xRP\_max is the maximum xRP across all configured per-UE measurement GAPs and/or per-FR measurement GAPs within the same FR, and starting from the beginning of any SMTC occasion:

- Ntotal is the total number of SMTC occasions that are covered by instances of the associated measurement gap within the window W, including those dropped and non-dropped instances of the associated measurement gap within the window, and

- Navailable is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W, after accounting for collisions between the GAPs by applying the GAP collision rule in section 9.1.8.3.

-- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

Kgap is only applicable for UE supporting concurrent measurement GAPs. When concurrent measurement GAPs are configured, requirements in this clause do not apply if Navailable =0.

Table 9.3.4-1: Time period for PSS/SSS detection (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TPSS/SSS\_sync\_inter |
| No DRX | Max(600ms, Ceil(8 \* Kgap) × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8\*1.5 \* Kgap) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(8 \* Kgap) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured. | |

Table 9.3.4-2: Time period for PSS/SSS detection, (Frequency range FR2)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TPSS/SSS\_sync\_inter |
| No DRX | Max(600ms, Ceil(Kgap × Mpss/sss\_sync\_inter x KFR) × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(1.5 \* Kgap × Mpss/sss\_sync\_inter x KFR) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Kgap × Mpss/sss\_sync\_inter x KFR) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured.  NOTE 4: KFR is a scaling factor depending on the frequency range and the SSB SCS. For FR2-1, KFR = 1. For FR2-2: KFR = 1 if the SCS of the SSB of the cell being detected is 120 kHz, KFR = 2 if the SCS of the SSB of the cell being detected is 480 kHz, and KFR = 3 if the SCS of the SSB of the cell being detected is 960 kHz. | |

Table 9.3.4-3: Time period for time index detection (Frequency range FR1)

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(120ms, Ceil(3 \* Kgap)× Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × 1.5 \* Kgap) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(3 \* Kgap)× DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement GAPs are configured. | |

Table 9.3.4-4: Time period for time index detection (Frequency range FR2)

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(200ms, Ceil(Kgap × MSSB\_index\_inter)× Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(1.5 \* Kgap × MSSB\_index\_inter) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Kgap ×MSSB\_index\_inter) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured. | |

Table 9.3.4-5: Time period for PSS/SSS detection when highSpeedMeasInterFreq-r17 is configured (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TPSS/SSS\_sync\_inter |
| No DRX | max(600ms, N1 × Max(MGRP, SMTC period)) × CSSFinter  N1 = 7 |
| DRX cycle ≤ 160ms | max(600ms, ceil(N2) x max(MGRP, SMTC period, DRX cycle)) x CSSFinter  N2 = 7 x M2 |
| 160ms < DRX cycle ≤ 320ms | ceil(N3) x DRX cycle x CSSFinter  N3 = 7 x M2 |
| DRX cycle>320ms | N4 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: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1  NOTE 3: N4=6 if SMTC periodicity > 40 ms, otherwise N4=5 | |

Table 9.3.4-6: Time period for time index detection when highSpeedMeasInterFreq-r17 is configured (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_time\_index\_inter |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × M2 NOTE3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 3 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. | |

Table 9.3.4-7: Time period for PSS/SSS detection when the inter-frequency carrier is configured only by SCG and the SCG is deactivated (FR2)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TPSS/SSS\_sync\_inter |
| No DRX | Max(600ms, Ceil(Kgap × Mpss/sss\_sync\_inter) × Max(MGRP, measCyclePSCell)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(1.5 \* Kgap × Mpss/sss\_sync\_inter) × Max(MGRP, measCyclePSCell, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Kgap × Mpss/sss\_sync\_inter) × Max(measCyclePSCell, DRX cycle) × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group.  NOTE 3: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured. | |

Table 9.3.4-8: Time period for time index detection when inter-frequency carrier is configured only by SCG and the SCG is deactivated (FR2)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_time\_index\_inter |
| No DRX | Max(200ms, Ceil(Kgap × MSSB\_index\_inter)× Max(MGRP, measCyclePSCell)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(1.5 \* Kgap × MSSB\_index\_inter) × Max(MGRP, measCyclePSCell, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Kgap ×MSSB\_index\_inter) × Max(measCyclePSCell, DRX cycle) × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1.  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured. | |

Table 9.3.4-9: Time period for PSS/SSS detection when *highSpeedMeasFlagFR2-r17* is configured, (FR2-1) when SMTC period <=40ms

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max(600ms, M1Note 3 x Kgap x max(MGRP, SMTC period)) x CSSFinter |
| DRX cycle≤ 80ms | max(600ms, ceil(M1Note 3 x Kgap) x max(MGRP, SMTC period, DRX cycle))x CSSFinter |
| 80ms< DRX cycle≤ 320ms | max(600ms, ceil(Mpss/sss\_sync\_with\_gaps x Kgap) x max(MGRP, SMTC period, DRX cycle))x CSSFinter |
| DRX cycle>320ms | Ceil( Mpss/sss\_sync\_with\_gaps x Kgap ) x max(MGRP, DRX cycle) x CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured.  NOTE 3: For UE supporting power class 6 and [*measurementEnhancementCAInterFreqFR2-r18*], M1= 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1= 18 if *highSpeedMeasFlagFR2-r17* = set2 | |

Table 9.3.4-10: Time period for time index detection when when *highSpeedMeasFlagFR2-r17* is configured (Frequency range FR2-1) when SMTC period <= 40ms

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_time\_index\_inter |
| No DRX | Max(200ms, Ceil(Kgap × , M1Note 3)× Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle≤ 80ms | Max(200ms, Ceil(1.5 \* Kgap × M1Note 3) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| 80ms< DRX cycle≤ 320ms | Max(200ms, Ceil(1.5 \* Kgap × MSSB\_index\_inter) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Kgap ×MSSB\_index\_inter) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured.  NOTE 3: For UE supporting power class 6 and [*measurementEnhancementCAInterFreqFR2-r18*], M1= 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1= 18 if *highSpeedMeasFlagFR2-r17* = set2 | |

#### 9.3.4.1 Void

#### 9.3.4.2 Void

### 9.3.5 Inter-frequency measurements

When measurement gaps are provided for inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, 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, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in table 9.3.5-1 and 9.3.5-2. When *highSpeedMeasInterFreq-r17* is configured, and UE supports *measurementEnhancementInterFreq-r17*, T SSB\_measurement\_period\_inter is specified in Table 9.3.5-3. When SCG is deactivated, T SSB\_measurement\_period\_inter is specified in Table 9.3.5-4 applies for inter-frequency carrier configured by SCG and not configured by MCG and table 9.3.5-2 applies for inter-frequency carrier configured by both SCG and MCG. Regardless of whether the SCG is activated or deactivated, table 9.3.5-2 applies for an inter-frequency carrier configured only by MCG.

Table 9.3.5-1: Measurement period for inter-frequency measurements with gaps (Frequency FR1)

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, Ceil(8 \* Kgap) × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × 1.5 \* Kgap) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(8 \* Kgap) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent measurement GAPs, the MGRP above is the MGRP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement GAPs are configured. | |

Table 9.3.5-2: Measurement period for inter-frequency measurements with gaps (Frequency FR2)

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(400ms, Ceil(Kgap × Mmeas\_period\_inter)× Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(400ms, Ceil(1.5 \* Kgap × Mmeas\_period\_inter) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Kgap × Mmeas\_period\_inter) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent measurement GAPs, the MGRP above is the MGRP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement GAPs are configured. | |

Table 9.3.5-3: Measurement period for inter-frequency measurements with gaps when highSpeedMeasInterFreq-r17 is configured (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | T SSB\_measurement\_period\_inter |
| No DRX | max(200ms, 7 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 160ms | max(200ms, ceil(7 x M2 NOTE3) x max(MGRP, SMTC period, DRX cycle)) x CSSFinter |
| 160ms < DRX cycle ≤ 320ms | ceil(7 x M2 NOTE3) x DRX cycle x CSSFinter |
| DRX cycle>320ms | 4 x M2 NOTE3 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: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1 | |

Table 9.3.5-4: Measurement period for inter-frequency measurements with gaps when the inter-frequency carrier is configured only by SCG and the SCG is deactivated (FR2)

|  |  |
| --- | --- |
| Condition NOTE1,2 | T SSB\_measurement\_period\_inter |
| No DRX | Max(400ms, Ceil(Kgap × Mmeas\_period\_inter)× Max(MGRP, measCyclePSCell)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(400ms, Ceil(1.5 \* Kgap × Mmeas\_period\_inter) × Max(MGRP, measCyclePSCell, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Kgap × Mmeas\_period\_inter) × Max(measCyclePSCell, DRX cycle) × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1.  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent measurement GAPs, the MGRP above is the MGRP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement GAPs are configured. | |

Table 9.3.5-5: Measurement period for inter-frequency measurements with gaps when *highSpeedMeasFlagFR2-r17* is configured (FR2-1) when SMTC period<=40ms

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_inter |
| No DRX | max(400ms, ceil(M1Note 3 x Kgap ) x max(MGRP, SMTC period)) x CSSFinter |
| DRX cycle≤ 80ms | max(400ms, ceil(M1Note 3 x Kgap) x max(MGRP, SMTC period, DRX cycle)) Note 1 x CSSFinter |
| 80ms< DRX cycle≤ 320ms | max(400ms, ceil(Mmeas\_period with\_gaps x Kgap) x max(MGRP, SMTC period, DRX cycle)) Note 1 x CSSFinter |
| DRX cycle>320ms | Ceil( Mmeas\_period with\_gaps x Kgap ) x max(MGRP, DRX cycle) x CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: For a UE supporting concurrent measurement GAPs, the MGRP above is the MGRP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement GAPs are configured.  NOTE 3: For UE supporting power class 6 and [*measurementEnhancementCAInterFreqFR2-r18*], M1= 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1= 18 if *highSpeedMeasFlagFR2-r17* = set2 | |

#### 9.3.5.1 Void

#### 9.3.5.2 Void

#### 9.3.5.3 Void

---------------------------------------Unchanged Omitted--------------------------------

### 9.3.9 Inter frequency measurements without measurement gaps

#### 9.3.9.1 Inter frequency Cell identification

UE satisfying the applicability conditions specified in 9.3.1 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 FR2-1 target frequency layers and 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.

- For inter-frequency SSB based measurements without measurement gaps in active BWP, it is assumed that when UE performs inter-frequency measurements without measurement gaps in a TDD bands on FR1 and FR2, SFN and frame boundary across serving cell and inter-frequency neighbor cells is aligned

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

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

Where:

TPSS/SSS\_sync\_inter: it is the time period used in PSS/SSS detection

* For inter-frequency SSB based measurements without measurement gaps in active BWP, and UE supports interFrequencyMeas-Nogap-r16, TPSS/SSS\_sync\_inter is given in table 9.3.9.1-1 and table 9.3.9.1-2.
* For UE indicating [nogap-nointerurption], TPSS/SSS\_sync\_inter is given in Table 9.3.9.1-1 for FR1 and Table 9.3.9.1-2 for FR2
* For UE indicating [nogap-interruption], TPSS/SSS\_sync\_inter is given in Table 9.3.9.1-1a for FR1 and Table 9.3.9.1-2a for FR2.

TSSB\_time\_index\_inter: it is the time period used to acquire the index of the SSB being measured

* For inter-frequency SSB based measurements without measurement gaps in active BWP, and UE supports interFrequencyMeas-Nogap-r16, TSSB\_time\_index\_inter is given in table 9.3.9.1-3 and table 9.3.9.1-4.
* For UE indicating [nogap-nointerurption], TSSB\_time\_index\_inter is given in Table 9.3.9.1-3 for FR1 and Table 9.3.9.1-4 for FR2
* For UE indicating [nogap-interruption], TSSB\_time\_index\_inter is given in Table 9.3.9.1-3a for FR1 and Table 9.3.9.1-4a for FR2.

T SSB\_measurement\_period\_inter: equal to a measurement period of SSB based measurement

* For inter-frequency SSB based measurements without measurement gaps in active BWP, and UE supports interFrequencyMeas-Nogap-r16, T SSB\_measurement\_period\_inter is given in table 9.3.9.2-1, table 9.3.9.2-2, table 9.3.9.2-3 and table 9.3.9.2-3a when *highSpeedMeasInterFreq-r17* is configured and UE supports measurementEnhancementInterFreq-r17, and table 9.3.9.2-4 when *highSpeedMeasFlagFR2-r17* is configured and UE supports [*measurementEnhancementCAInterFreqFR2-r18*].
* For UE indicating [nogap-nointerurption], T SSB\_measurement\_period\_inter is given in Table 9.3.9.2-1 for FR1, table 9.3.9.2-2 for FR2, and table 9.3.9.2-3 when *highSpeedMeasInterFreq-r17* is configured and UE supports measurementEnhancementInterFreq-r17.
* For UE indicating [nogap-interruption], T SSB\_measurement\_period\_inter is given in Table 9.3.9.2-1a for FR1 and table 9.3.9.2-2a for FR2, and table 9.3.9.2-3b when *highSpeedMeasInterFreq-r17* is configured and UE supports measurementEnhancementInterFreq-r17.

- For UE supporting power class 6 and [*measurementEnhancementCAInterFreqFR2-r18*] with *highSpeedMeasFlagFR2-r17* configured, if SMTC <= 40ms, TSSB\_measurement\_period\_inter is given in Table 9.3.9.2-x; otherwise, TSSB\_measurement\_period\_inter is given in Table 9.3.9.2-2.

CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFoutside\_gap,i in clause 9.1.5.1 for measurement conducted outside GAP, i.e. when interfrequency SMTC is fully non overlapping or partially overlapping with GAP.

* when inter-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps for UE indicating [nogap-nointerruption] or
* when inter-frequency SMTC is fully non overlapping with measurement gaps for UE indicating [no gap with interruption],

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

Mpss/sss\_sync\_inter: For a UE supporting FR2-1 power class 1 or 5, Mpss/sss\_sync\_inter = 40. For a UE supporting FR2-1 power class 2, Mpss/sss\_sync\_inter = 24. For a UE supporting FR2-1 power class 3, Mpss/sss\_sync\_inter = 24. For a UE supporting FR2-1 power class 4, Mpss/sss\_sync = 24. For a UE supporting FR2-2 power class 1, Mpss/sss\_sync\_inter = 60. For a UE supporting FR2-2 power class 2, Mpss/sss\_sync\_inter = 36. For a UE supporting FR2-2 power class 3, Mpss/sss\_sync\_inter = 36. For FR1, Mpss/sss\_sync\_inter = 5.

MSSB\_index\_inter: For a UE supporting FR2-2 power class 1, MSSB\_index\_inter = 72. For a UE supporting FR2-2 power class 2, MSSB\_index\_inter = 48. For a UE supporting FR2-2 power class 3, MSSB\_index\_inter = 48. For FR1, MSSB\_index\_inter = 3.

Mmeas\_period\_inter: For a UE supporting FR2-1 power class 1 or 5, Mmeas\_period\_inter = 40. For a vehicle mounted UE supporting FR2-1 power class 2, Mpss/sss\_sync\_inter=24. For a UE supporting FR2-1 power class 3, Mmeas\_period\_inter = 24. For a UE supporting FR2-1 power class 4, Mmeas\_period\_inter = 24. For a UE supporting FR2-2 power class 1, Mmeas\_period\_inter = 60. For a UE supporting FR2-2 power class 2, Mpss/sss\_sync\_inter = 36. For a UE supporting FR2-2 power class 3, Mmeas\_period\_inter = 36. For FR1, Mmeas\_period\_inter = 5.

If the UE indicates ‘nogap-noncsg’ via *NeedForGapNCSG-InfoNR* for the inter-frequency measurement or the UE indicates either [*nogap-intrruption*] or [nogap-nointerruption] via [*NeedForGap-InfoNR-R18]*,

Mpss/sss\_sync\_inter: For a UE supporting FR2-1 power class 1 or 5, Mpss/sss\_sync\_inter = 64 samples. For a UE supporting FR2-1 power class 2, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2-1 power class 3, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2-1 power class 4, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2-2 power class 1, Mpss/sss\_sync\_inter = 96. For a UE supporting FR2-2 power class 2, Mpss/sss\_sync\_inter = 60. For a UE supporting FR2-2 power class 3, Mpss/sss\_sync\_inter = 60. For FR1, Mpss/sss\_sync\_inter = 8.

MSSB\_index\_inter: For a UE supporting FR2-1 power class 1 or 5, MSSB\_index\_inter = 40 samples. For a UE supporting FR2 power class 2, MSSB\_index\_inter = 24 samples. For a UE supporting FR2-1 power class 3, MSSB\_index\_inter = 24 samples. For a UE supporting FR2-1 power class 4, MSSB\_index\_inter = 24 samples. For a UE supporting FR2-2 power class 2 or 3, MSSB\_index\_inter = 48 samples. For a UE supporting FR2 power class 1, MSSB\_index\_inter = 72 samples. For FR1, MSSB\_index\_inter = 3.

Mmeas\_period\_inter: For a UE supporting FR2-1 power class 1 or 5, Mmeas\_period\_inter =64. For a UE supporting FR2-1 power class 2, Mmeas\_period\_inter=40. For a UE supporting FR2-1 power class 3, Mmeas\_period\_inter =40. For a UE supporting FR2-1 power class 4, Mmeas\_period\_inter = 40. For a UE supporting FR2-2 power class 1, Mmeas\_period\_inter = 96. For a UE supporting FR2-2 power class 2, Mmeas\_period\_inter = 60. For a UE supporting FR2-2 power class 3, Mmeas\_period\_inter = 60. For FR1, Mmeas\_period\_inter = 8.

When UE supports and is configured with concurrent measurement GAPs,

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

For a window W of duration max(SMTC period, xRP\_max), where xRP max is the maximum xRP across all configured per-UE GAPs and per-FR GAPs within the same FR as the SSB frequency layer, and starting at the beginning of any SMTC occasion:

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

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

-- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG. Kp = 1 when Navailable = 0.

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

When interfrequency SMTC is fully non overlapping with measurement gaps or NCSG, or interfrequency SMTC is fully overlapping with MGs or NCSG, Kp =1.

When interfrequency 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 FR2,

Klayer1\_measurement=1,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap are not fully overlapped by inter-frequency SMTC occasions, or

- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap and fully-overlapped by inter-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured, where SSB symbols are indicated by *SSB-ToMeasure* and RSSI symbols are indicated by *SS-RSSI-Measurement*;

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 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 9.3.9.1-1: Time period for PSS/SSS detection, (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max( 600ms, ceil(Mpss/sss\_sync\_inter x Kp) x SMTC period )Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max( 600ms, ceil(M2x Mpss/sss\_sync\_inter x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil(Mpss/sss\_sync\_inter x Kp) 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: When *highSpeedMeasInterFreq-r17* is not configured, M2 = 1.5; When *highSpeedMeasInterFreq-r17* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 | |

Table 9.3.9.1-1a: Time period for PSS/SSS detection, when UE indicate *[nogap-interruption]* (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max( 600ms, Mpss/sss\_sync\_inter x max(80ms, SMTC period) )Note 1 x CSSFinter |
| [DRX cycle≤ 320ms] | max( 600ms, ceil(M2 x Mpss/sss\_sync\_inter) x max(80ms, SMTC period,DRX cycle)) x CSSFinter |
| [DRX cycle>320ms] | Mpss/sss\_sync\_inter 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: When *highSpeedMeasInterFreq-r17* is not configured, M2 = 1.5; When *highSpeedMeasInterFreq-r17* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 | |

Table 9.3.9.1-2: Time period for PSS/SSS detection, (FR2)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max(600ms, ceil(Mpss/sss\_sync\_inter x Kp x Klayer1\_measurement)x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(600ms, ceil(1.5 x Mpss/sss\_sync\_inter x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil(Mpss/sss\_sync\_inter x Kp 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 | |

Table 9.3.9.1-2a: Time period for PSS/SSS detection, when UE indicate [nogap-interruption] (FR2)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max(600ms, ceil(Mpss/sss\_sync\_inter x Klayer1\_measurement)x max(80ms, SMTC period))Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(600ms, ceil(1.5 x Mpss/sss\_sync\_inter x Klayer1\_measurement)x [max(80ms,SMTC period, DRX cycle)]) x CSSFinter |
| DRX cycle>320ms | ceil(Mpss/sss\_sync\_inter 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 | |

Table 9.3.9.1-3: Time period for time index detection (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_inter |
| No DRX | max(120ms, ceil(MSSB\_index\_inter x Kp )x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(120ms, ceil (M2 x MSSB\_index\_inter x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | Ceil(MSSB\_index\_inter x Kp) 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: When *highSpeedMeasInterFreq-r17* is not configured, M2 = 1.5; When *highSpeedMeasInterFreq-r17* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 | |

Table 9.3.9.1-3a: Time period for time index detection, when UE indicate [nogap-interruption] (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_inter |
| No DRX | max(120ms, MSSB\_index\_inter x max(80ms, SMTC period))Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(120ms, ceil (M2 x MSSB\_index\_inter) x [max(80ms, SMTC period, DRX cycle)]) x CSSFinter |
| DRX cycle>320ms | MSSB\_index\_inter 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: When *highSpeedMeasInterFreq-r17* is not configured, M2 = 1.5; When *highSpeedMeasInterFreq-r17* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 | |

Table 9.3.9.1-4: Time period for time index detection (FR2)

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(200ms, Ceil(MSSB\_index\_inter x Kp)× SMTC period) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(1.5 × MSSB\_index\_inter x Kp) × Max(SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(MSSB\_index\_inter x Kp) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: Kp is applicable for UE supporting *concurrentMeasGap-r17* | |

Table 9.3.9.1-4a: Time period for time index detection, when UE indicate [nogap-interruption] (FR2)

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(200ms, MSSB\_index\_inter × max(80ms, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(1.5 × MSSB\_index\_inter) × Max(80ms, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | MSSB\_index\_inter × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: Kp is applicable for UE supporting [concurrent gaps] | |

#### 9.3.9.2 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, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in table 9.3.9.2-1 and 9.3.9.2-2, if UE supports inter-frequency measurement without measurement gaps. When highSpeedMeasInterFreq-r17 is configured and UE supports [measurementEnhancementInterFreq-r17], T SSB\_measurement\_period\_inter is specified in table 9.3.9.2-3.

Table 9.3.9.2-1: Measurement period for inter-frequency measurements without gaps ((FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_inter |
| No DRX | max(200ms, ceil(Mmeas\_period\_inter x Kp) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5x Mmeas\_period\_inter x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil( Mmeas\_period\_inter x Kp ) 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 | |

Table 9.3.9.2-1a: Measurement period for inter-frequency measurements without gaps when UE indicate [nogap-interruption] (FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_inter |
| No DRX | max(200ms, Mmeas\_period\_inter x max(80ms, SMTC period))Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5x Mmeas\_period\_inter) x max(80ms, SMTC period, DRX cycle)) x CSSFinter |
| DRX cycle>320ms | Mmeas\_period\_inter 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 | |

Table 9.3.9.2-2: Measurement period for inter-frequency measurements without gaps (FR2)

|  |  |
| --- | --- |
| **DRX cycle** | **T SSB\_measurement\_period\_inter** |
| No DRX | max(400ms, ceil(Mmeas\_period\_inter x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5x Mmeas\_period\_inter x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil(Mmeas\_period\_inter xKp 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 | |

Table 9.3.9.2-2a: Measurement period for inter-frequency measurements without gaps when UE indicate [nogap-interruption (FR2)

|  |  |
| --- | --- |
| **DRX cycle** | **T SSB\_measurement\_period\_inter** |
| No DRX | max(400ms, ceil(Mmeas\_period\_inter x Klayer1\_measurement) x max(80ms, SMTC period))Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5x Mmeas\_period\_inter x Klayer1\_measurement) x max(80ms, SMTC period, DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil(Mmeas\_period\_inter 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 | |

Table 9.3.9.2-3: Measurement period for inter-frequency measurements without gaps in the active BWP when highSpeedMeasInterFreq-r17 is configured (FR1)

|  |  |
| --- | --- |
| **DRX cycle** | **T SSB\_measurement\_period\_inter** |
| No DRX | max(200ms, ceil( 5 x Kp) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 160ms | max(200ms, ceil(5 x M2 Note 2 x Kp) x max(SMTC period, DRX cycle)) x CSSFinter |
| 160ms < DRX cycle≤ 320ms | ceil(4 x M2 Note 2 x Kp) x max(SMTC period,DRX cycle) x CSSFinter |
| DRX cycle>320ms | ceil( Y Note 3 x Kp ) 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: M2 = 1.5 if SMTC period > 40 ms, otherwise M2 = 1  NOTE 3: Y=3 when SMTC period <= 40ms, Y=5 when SMTC period > 40ms | |

Table 9.3.9.2-3a: Measurement period for inter-frequency measurements without gaps when highSpeedMeasInterFreq-r17 is configured (FR1), UE supporting ‘nogap-noncsg’

|  |  |
| --- | --- |
| Condition NOTE1,2 | T SSB\_measurement\_period\_inter |
| No DRX | max(200ms, 7 × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 160ms | max(200ms, ceil(7 x M2 NOTE3) x max(MGRP, SMTC period, DRX cycle)) x CSSFinter |
| 160ms < DRX cycle ≤ 320ms | ceil(7 x M2 NOTE3) x DRX cycle x CSSFinter |
| DRX cycle>320ms | 4 x M2 NOTE3 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: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1 | |

Table 9.3.9.2-3b: Measurement period for inter-frequency measurements without gaps when highSpeedMeasInterFreq-r17 is configured (FR1), when UE indicate [nogap-interruption]

|  |  |
| --- | --- |
| Condition NOTE1,2 | T SSB\_measurement\_period\_inter |
| No DRX | max(200ms, 7 × Max(80ms, SMTC period)) × CSSFinter |
| DRX cycle ≤ 160ms | max(200ms, ceil(7 x M2 NOTE3) x max(80ms, SMTC period, DRX cycle)) x CSSFinter |
| 160ms < DRX cycle ≤ 320ms | ceil(7 x M2 NOTE3) x DRX cycle x CSSFinter |
| DRX cycle>320ms | 4 x M2 NOTE3 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: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1 | |

Table 9.3.9.2-4: Measurement period for inter-frequency measurements without gaps when *highSpeedMeasFlagFR2-r17* is configured (FR2-1) when SMTC period <= 40ms

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_inter |
| No DRX | max(400ms, ceil(M1Note 2 x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 80ms | max(400ms, ceil(M1Note 2 x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFinter |
| 80ms< DRX cycle≤ 320ms | ceil(1.5x Mmeas\_period\_w/o\_gaps Note 3 x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle) x CSSFinter |
| DRX cycle>320ms | ceil(Mmeas\_period\_w/o\_gaps Note 3 xKp 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 UE supporting power class 6 and [*measurementEnhancementCAInterFreqFR2-r18*], M1= 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1= 18 if *highSpeedMeasFlagFR2-r17* = set2 | |

#### 9.3.9.3 Scheduling availability of UE during inter-frequency measurements when the SSB is completely contained in the active BWP of the UE

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.

The scheduling availability requirements when UE performs inter-frequency measurements without measurement gaps in a TDD bands on FR1 and FR2 in clause 9.3.9.3.1~9.3.9.3.3 are valid under the following conditions:

- SFN and frame boundary across serving cell and inter-frequency neighbor cells is aligned

##### 9.3.9.3.1 Scheduling availability of UE performing measurements in TDD bands on FR1

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

- 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.

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

- 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.

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

##### 9.3.9.3.2 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 in a TDD band, 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 UE performs inter-frequency measurements without measurement gaps in a FDD band, 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 7.9, 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 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 aforementioned restricted symbols.

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

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

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.

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

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on 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*.*

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 aforementioned restricted symbols.

If 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.

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, the UE is expected to receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, the UE is expected to receive PDSCH that corresponds to the PDCCH that the UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured.

##### 9.3.9.3.4 Scheduling availability of UE performing measurements on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to measurements performed on FR2 serving cell frequency layer.

There are no scheduling restrictions on FR2 serving cell(s) due to measurements performed on FR1 serving cell frequency layer.

#### 9.3.9.4 Scheduling availability of UE during inter-frequency measurements when the SSB is not completely contained in the active BWP of the UE

If UE supports *nr-NeedForGapNCSG-reporting-r17* and indicates *nogap-noncsg* in *NeedForGapNCSG-InfoNR* for inter-frequency measurement, or if UE supports [*NeedForInterruptionNR-r18*] and indicates *nogap* in *NeedforGap-InfoNR* and further indicates [*no-gap-no-interruption]* or [*no-gap-with-interruiton]* via [*NeedForInterruptionNR-r18]* for inter-frequency measurement*,* UE is required to be capable of measuring without measurement gaps when the SSB is not 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.

The requirements in clause 9.3.9.4 based on *deriveSSB-IndexFromCell-inter* apply provided that UE supports ncsg-*SymbolLevelScheduleRestrictionInter-r17*. If UE does not support *ncsg-SymbolLevelScheduleRestrictionInter-r17*, the requirements in clause 9.3.9.4.3 apply assuming *deriveSSB-IndexFromCell-inter* is not enabled.

##### 9.3.9.4.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When the UE performs inter-frequency measurements without MG and NCSG in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement when (1) *simultaneousRxTxInterBandCA* is not supported for the target measurement band and the serving cell’s band, or (2) target measurement and the serving cell are on the same band

The UE is not expected to transmit PUCCH/PUSCH/SRS 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*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- 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*.

When the UE performs inter-frequency measurements without MG and NCSG in a TDD band, the following restrictions apply due to SS-RSRQ measurement when *simultaneousRxTxInterBandCA* is not supported for the target measurement band and the serving cell band

The UE is not expected to transmit PUCCH/PUSCH/SRS 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 RSSI measurement symbols, and △t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- 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*.

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 or TDD inter-band carrier aggregation without *simultaneousRxTxInterBandCA* support is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When the UE performs inter-frequency measurements without MG and NCSG in a TDD band and *simultaneousRxTxInterBandCA* is supported for the target measurement band and a serving cell’ band, no scheduling restriction applies to the serving cell.

##### 9.3.9.4.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement when the target inter-frequency layer to be measured is on the same band with UE’s serving cell(s).

Editor’s note: FFS when target frequency layer to be measured is on the different band but with overlapped spectrum with UE’s serving cell(s)

- The UE is not expected to 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*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- 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,*

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 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.

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

When (1) UE does not support IBM between target measurement band and serving cell’s band(s) nor *simultaneousRxTxInterBandCA*, or (2) target measurement and a serving cell are on the same band, the following scheduling restriction applies to the serving cell due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell without MG and NCSG:

The 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*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- 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*,

and due to SS-RSRQ measurement on an FR2 inter-frequency cell without MG and NCSG

The 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 RSSI measurement symbols, and △t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- 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*.

When UE does not support IBM between target measurement band and serving cell’s band(s) but supports *simultaneousRxTxInterBandCA*, the following scheduling restriction applies to the serving cell due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell without MG and NCSG

The UE is not expected to 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*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- 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*,

and due to SS-RSRQ measurement on an FR2 inter-frequency cell without MG and NCSG

The UE is not expected to 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 RSSI measurement symbols, and △t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- 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*.

When UE supports IBM between target measurement band and serving cell’s band(s) but not *simultaneousRxTxInterBandCA*, the following scheduling restriction applies to the serving cell due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell without MG and NCSG

The UE is not expected to transmit PUCCH/PUSCH/SRS 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*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9..

- 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,*

and due to SS-RSRQ measurement on an FR2 inter-frequency cell without MG and NCSG

The UE is not expected to transmit PUCCH/PUSCH/SRS 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 RSSI measurement symbols, and △t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- 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*.

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 UE supports IBM between target measurement band and serving cell’s band(s) and *simultaneousRxTxInterBandCA*, no scheduling restriction applies to the serving cell.

If 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

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, the UE is expected to receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, the UE is expected to receive PDSCH that corresponds to the PDCCH that the UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured.

##### 9.3.9.4.4 Scheduling availability of UE performing measurements on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to measurements performed on FR2 frequency layer.

There are no scheduling restrictions on FR2 serving cell(s) due to measurements performed on FR1 frequency layer.

---------------------------------------Unchanged Omitted--------------------------------

### 9.3.10 Inter-frequency measurement with NCSG

#### 9.3.10.1 Inter-frequency cell identification

For the UE supporting NCSG, if NCSG is provided, the UE 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. 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 + T SSB\_measurement\_period\_inter) ms

Tidentify\_inter\_with\_index = (TPSS/SSS\_sync\_inter + T SSB\_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 9.3.10.1-1 and table 9.3.10.1-2.

TSSB\_time\_index\_inter: it is the time period used to acquire the index of the SSB being measured given in table 9.3.10.1-3 and table 9.3.10.1-4.

TSSB\_measurement\_period\_inter: equal to a measurement period of SSB based measurement given in table 9.3.10.2-1 and table 9.3.10.2-2.

Mpss/sss\_sync\_inter: For a UE supporting FR2 power class 1 or 5, Mpss/sss\_sync\_inter = 64 samples. For a UE supporting FR2 power class 2, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2 power class 3, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2 power class 4, Mpss/sss\_sync\_inter = 40 samples.

MSSB\_index\_inter: For a UE supporting FR2 power class 1 or 5, MSSB\_index\_inter = 40 samples. For a UE supporting FR2 power class 2, MSSB\_index\_inter = 24 samples. For a UE supporting FR2 power class 3, MSSB\_index\_inter = 24 samples. For a UE supporting FR2 power class 4, MSSB\_index\_inter = 24 samples.

Mmeas\_period\_inter: For a UE supporting FR2 power class 1 or 5, Mmeas\_period\_inter =64 samples. For a UE supporting FR2 power class 2, Mmeas\_period\_inter=40 samples. For a UE supporting FR2 power class 3, Mmeas\_period\_inter =40 samples. For a UE supporting FR2 power class 4, Mmeas\_period\_inter = 40 samples.

CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFwithin\_ncsg,i in clause 9.1.5.x for measurement conducted within NCSG.

KNCSG is the scaling factor for a SSB frequency layer to be measured within an associated NCSG pattern. KNCSG = 1 when the UE is not configured with concurrent measurement GAPs. Otherwise, KNCSG = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

For a window W of duration max(SMTC period, xRP\_max), where xRP max is the maximum xRP across all configured per-UE measurement GAPs and per-FR measurement GAPs within the same FR as the SSB frequency layer, and starting from the beginning of any SMTC occasion:

-- Ntotal is the total number of SMTC occasions that are covered by instances of the associated NCSG within the window W, including those overlapped with other GAP occasions within the window, and

-- Navailable is the number of SMTC occasions that are covered by instances of the non-dropped associated NCSG within the window W after accounting for GAP collisions by applying the GAP collision rule in section 9.1.8.3.

-- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

When concurrent measurement GAPs are configured, requirements in this clause do not apply if Navailable =0.

**Table 9.3.10.1-1: Time period for PSS/SSS detection with NCSG (FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX | Max(600ms, 8 × KNCSG × Max(VIRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8\*1.5 × KNCSG) × Max(VIRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × KNCSG × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 9.3.10.1-2: Time period for PSS/SSS detection with NCSG (FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX | Max(600ms, Mpss/sss\_sync\_inter × KNCSG × Max(VIRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, (1.5 × Mpss/sss\_sync\_inter × KNCSG) × Max(VIRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Mpss/sss\_sync\_inter × KNCSG × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 9.3.10.1-3: Time period for time index detection with NCSG (FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(120ms, 3 × KNCSG × Max(VIRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × 1.5 × KNCSG) × Max(VIRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 3 × KNCSG × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 9.3.**10**.1-4: Time period for time index detection with NCSG (FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(200ms, MSSB\_index\_inter × KNCSG × Max(VIRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, (1.5 × MSSB\_index\_inter × KNCSG) × Max(VIRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | MSSB\_index\_inter × KNCSG × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

#### 9.3.10.2 Measurement period

When NCSG are provided for inter frequency measurements, 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, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in table 9.3.10.2-1 and 9.3.10.2-2:

**Table 9.3.10.2-1: Measurement period for inter-frequency measurements with NCSG (FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × KNCSG × Max(VIRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × 1.5 × KNCSG) × Max(VIRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × KNCSG × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 9.3.10.2-2: Measurement period for inter-frequency measurements with NCSG (FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(400ms, Mmeas\_period\_inter × KNCSG × Max(VIRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(400ms, (1.5 × Mmeas\_period\_inter × KNCSG) × Max(VIRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Mmeas\_period\_inter × KNCSG × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**--------END OF CHANGE 18: 9.3.1/4/5/9/10 [R4-2317301/292] ----------**

**------------ START OF CHANGE 19: 9.4.2/3 [R4-2317292] --------------**

### 9.4.2 NR − E-UTRAN FDD measurements

#### 9.4.2.1 Introduction

The requirements are applicable for NR−E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN FDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

- RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

- RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].

#### 9.4.2.2 Requirements when no DRX is used

When the UE requires measurement gaps or NCSG to identify and measure inter-RAT cells and an appropriate measurement gap pattern or NCSG is scheduled, or when the UE is capable of concurrent measurement gap patterns and concurrent measurement gap patterns are scheduled, or an appropriate pre-MG is scheduled and activated, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD cell within TIdentify, E-UTRAN FDD according to the following expression:

,

where:

TBasicIdentify = 480 ms,

TInter1 is defined in clause 9.4.1,

CSSFinterRAT = CSSFwithin\_gap,i when measurement gaps are configured, or CSSFwithin\_ncsg,i when NCSGs are configured, is the scaling factor for the measured inter-RAT E-UTRA carrier *i* which is calculated as specified in clause 9.1.5.2.

For a UE supporting and configured with concurrent measurement GAPs, Kgap\_EUTRA: it is the scaling factor for an E-UTRAN frequency layer to be measured within the associated GAP pattern. Kgap = 1 when the UE is not configured with concurrent measurement GAPs. Otherwise, Kgap\_EUTRA = Ntotal / Navailable for UE configured with concurrent measurement GAPs.

For a window W of duration xRP\_max, where xRP\_max is the maximum xRP across all configured per-UE measurement GAPs and per-FR measurement GAPs for FR1, and starting from the beginning of any associated gap occasion:

Ntotal is the total number of associated GAP occasions within the window, including those dropped and non-dropped ocassions of the associated GAP within the window, and

Navailable is the number of non-dropped associated GAP occasions after accounting for collisions between the GAPs by applying the GAP collision rule in section 9.1.8.3.

xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

Requirements do not apply for UE configured with concurrent measurement GAPs, if Navailable =0

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasure, E-UTRAN FDD defined in Table 9.4.2.2-1.

**Table 9.4.2.2-1:** M**easurement period and measurement bandwidth**

|  |  |  |
| --- | --- | --- |
| **Configuration** | **Physical Layer Measurement period: TMeasure, E-UTRAN FDD [ms]** | **Measurement bandwidth [RB]** |
| 0 | 480 x [CSSFinterRAT x Ceil(Kgap\_EUTRA)] | 6 |
| 1 (Note 1) | 240 x [CSSFinterRAT x Ceil(Kgap\_EUTRA)] | 50 |
| NOTE 1: This configuration is optional.  NOTE 2: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1 | | |

When measurement gaps are scheduled for E-UTRAN FDD inter-RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement period TMeasure, E-UTRAN FDDgiven by table 9.4.2.2-1.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

#### 9.4.2.3 Requirements when DRX is used

When DRX is in use and an appropriate measurement gap pattern or NCSG is configured, or when the UE is capable of concurrent measurement gap patterns and concurrent measurement gap patterns are configured, or an appropriate pre-MG is scheduled and activated, the UE shall be able to identify a new detectable E-UTRAN FDD cell within TIdentify, E-UTRAN FDD specified in Table 9.4.2.3-1. When *highSpeedMeasFlag-r16* is configured and UE supports the enhanced inter-RAT E-UTRAN measurement requirements, the UE shall be able to identify a new detectable E-UTRAN FDD cell within TIdentify, E-UTRAN FDD specified in Table 9.4.2.3-2.

For a UE supporting and configured with concurrent measurement GAPs, Kgap\_EUTRA: it is the scaling factor for an E-UTRAN frequency layer to be measured within the associated GAP pattern. Kgap = 1 when the UE is not configured with concurrent measurement GAPs. Otherwise, Kgap\_EUTRA = Ntotal / Navailable for UE configured with concurrent measurement GAPs.

For a window W of duration xRP\_max, where xRP\_max is the maximum xRP across all configured per-UE GAPs and per-FR GAPs for FR1, and starting from the beginning of any associated gap occasion:

Ntotal is the total number of associated GAP occasions within the window, including both dropped and non-dropped instances of the associated GAP within the window, and

Navailable is the number of non-dropped associated GAP occasions after accounting for collisions between the GAPs by applying the GAP collision rule in section 9.1.8.3.

xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

Requirements do not apply for UE configured with concurrent measurement GAPs, if Navailable =0

Table 9.4.2.3-1: Requirement to identify a newly detectable E-UTRAN FDD cell

|  |  |  |
| --- | --- | --- |
| **DRX cycle length (s)** | **TIdentify, E-UTRAN FDD (s) (DRX cycles)** | |
|  | Gap/NCSG period = 40 ms, 20 ms | Gap/NCSG period = 80 ms |
| ≤0.16 | Non-DRX requirements in clause 9.4.2.2 apply | Non-DRX requirements in clause 9.4.2.2 apply |
| 0.256 | 5.12\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | 7.68\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (30\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 0.32 | 6.4\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | 7.68\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (24\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 0.32< DRX-cycle ≤10.24 | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.2.2.  NOTE 3: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1  NOTE 4: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer. | | |

Table 9.4.2.3-2: Requirement to identify a newly detectable E-UTRAN FDD cell when *highSpeedMeasFlag-r16* is configured

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | TIdentify, E-UTRAN FDD (s) (DRX cycles) | |
|  | Gap/NCSG period = 40 ms, 20 ms | Gap/NCSG period = 80 ms |
| ≤0.16 | Non-DRX requirements in clause 9.4.2.2 apply | Non-DRX requirements in clause 9.4.2.2 apply |
| 0.16<DRx cycle<=0.32 | Note 1(15\*CSSFinterRAT x Ceil((Kgap\_EUTRA)) |  |
| 0.32<DRx cycle <= 0.64 | Note 1(10\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |  |
| DRx cycle = 1.024 | Note 1(10\*CSSFinterRAT x Ceil( Kgap\_EUTRA)) | Note 1(10\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| DRx cycle = 1.28 | Note 1(8\*CSSFinterRAT x Ceil( Kgap\_EUTRA)) | Note 1(8\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 1.28< DRX-cycle ≤10.24 | Note1 (20\*CSSFinterRAT x Ceil( Kgap\_EUTRA)) | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.2.2.  NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[interRAT-MeasurementEnhancement-r16].*  NOTE 4: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1  NOTE 5: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer. | | |

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN FDD cells per E-UTRA FDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA FDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure, E-UTRAN FDD specified in Table 9.4.2.3-2.

**Table 9.4.2.3-2: Requirement to measure E-UTRAN FDD cells**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure, E-UTRAN FDD (s) (DRX cycles)** |
| ≤0.08 | Non-DRX requirements in clause 9.4.2.2 apply |
| 0.08< DRX-cycle ≤10.24 | Note1 (5\* CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.2.2.  NOTE 3: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1 | |

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

#### 9.4.2.4 Measurement reporting requirements

##### 9.4.2.4.1 Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

##### 9.4.2.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.2.4.3.

##### 9.4.2.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

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 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 where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. 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 less than T Identify, E-UTRAN FDD defined in clauses 9.4.2.2 and 9.4.2.3 without DRX and with DRX, respectively.When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify, E-UTRAN FDD becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than TMeasure, E-UTRAN FDD provided the timing to that cell has not changed more than ± 50 Ts while measurement gap or NCSG has not been available and the L3 filter has not been used.

### 9.4.3 NR − E-UTRAN TDD measurements

#### 9.4.3.1 Introduction

The requirements are applicable for NR−E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN TDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

- RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].

#### 9.4.3.2 Requirements when no DRX is used

When the UE requires measurement gaps or NCSG to identify and measure inter-RAT cells and an appropriate measurement gap pattern or NCSG is scheduled, or when the UE is capable of concurrent measurement gap patterns and concurrent measurement gap patterns are scheduled, or an appropriate pre-MG is scheduled and activated or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable TDD cell within TIdentify, E-UTRAN TDD according to the following expression:

- When configuration 0 or configuration 1 in Table 9.4.3.2-1 is applied,

,

- When configuration 2 or configuration 3 in Table 9.4.3.2-1 is applied,

,

where:

TBasicIdentify = 480 ms,

TInter1 is defined in clause 9.4.1,

CSSFinterRAT = CSSFwithin\_gap,i when measurement gaps are configured, or CSSFwithin\_ncsg,i when NCSGs are configured, is the scaling factor for the measured inter-RAT E-UTRA carrier *i* which is calculated as specified in clause 9.1.5.2.

For a UE supporting and configured with concurrent measurement GAPs, Kgap\_EUTRA: it is the scaling factor for an E-UTRAN frequency layer to be measured within the associated GAP pattern. Kgap = 1 when the UE is not configured with concurrent measurement GAPs. Otherwise, Kgap\_EUTRA = Ntotal / Navailable for UE configured with concurrent measurement GAPs.

- For a window W of duration xRP\_max , where xRP\_max is the maximum xRP across all configured per-UE measurement GAPs and per-FR measurement GAPs for FR1, and starting from the beginning of any associated gap occasion:

- Ntotal is the total number of associated GAP occasions within the window, including those dropped and non-dropped ocassions of the associated GAP within the window, and

- Navailable is the number of non-dropped associated GAP occasions after accounting for collisions between the GAPs by applying the GAP collision rule in section 9.1.8.3.

-- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

- Requirements do not apply for UE configured with concurrent measurement GAPs, if Navailable =0

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasure, E-UTRAN TDD defined in Table 9.4.3.2-1.

Table 9.4.3.2-1: TMeasure, E-UTRAN TDD for different configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Configuration | Measurement bandwidth (RB) | Number of UL/DL sub-frames per half frame (5 ms) | | DwPTS | | TMeasure, E-UTRAN TDD (ms) |
|  |  | DL | UL | Normal CP | Extended CP |  |
| 0 | 6 | 2 | 2 |  |  | 480 x CSSFinterRAT x Ceil(Kgap\_EUTRA) |
| 1 (Note 1) | 50 | 2 | 2 |  |  | 240 x CSSFinterRAT x Ceil(Kgap\_EUTRA) |
| 2 | 6 | 1 | 3 |  |  | 720 x CSSFinterRAT x Ceil(Kgap\_EUTRA) |
| 3 (Note 1) | 50 | 1 | 3 |  |  | 480 x CSSFinterRAT x Ceil(Kgap\_EUTRA) |
| NOTE 1: This configuration is optional.  NOTE 2: Void  NOTE 3: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1 | | | | | | |

When measurement gaps are scheduled for E-UTRAN TDD inter-RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement period Tmeasure, E-UTRAN TDD given by table 9.4.3.2-1.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

#### 9.4.3.3 Requirements when DRX is used

When DRX is in use and an appropriate measurement gap pattern or NCSG is configured, or when the UE is capable of concurrent measurement gap patterns and concurrent measurement gap patterns are configured, or an appropriate pre-MG is scheduled and activated, the UE shall be able to identify a new detectable E-UTRAN TDD cell within TIdentify, E-UTRAN TDD specified in Table 9.4.3.3-1. When *highSpeedMeasFlag-r16* is configured and UE supports the enhanced inter-RAT E-UTRAN measurement requirements, the UE shall be able to identify a new detectable E-UTRAN TDD cell within TIdentify, E-UTRAN TDD specified in Table 9.4.3.3-2.

For a UE supporting and configured with concurrent measurement GAPs, Kgap\_EUTRA: it is the scaling factor for an E-UTRAN frequency layer to be measured within the associated GAP pattern. Kgap = 1 when the UE is not configured with concurrent measurement GAPs. Otherwise, Kgap\_EUTRA = Ntotal / Navailable for UE configured with concurrent measurement GAPs.

For a window W of duration xRP\_max, where xRP\_max is the maximum xRP across all configured per-UE measurement GAPs and per-FR measurement GAPs for FR1, and starting from the beginning of any associated gap occasion:

Ntotal is the total number of associated GAP occasions within the window, including both dropped and non-dropped instances of the associated GAP within the window, and

Navailable is the number of non-dropped associated GAP occasions after accounting for collisions between the GAPs by applying the GAP collision rule in section 9.1.8.3.

-- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

Requirements do not apply for UE configured with concurrent measurement GAPs, if Navailable =0

Table 9.4.3.3-1: Requirement to identify a newly detectable E-UTRAN TDD cell

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | TIdentify, E-UTRAN TDD (s) (DRX cycles) | |
|  | Gap/NCSG period = 40 ms, 20 ms | Gap/NCSG period = 80 ms |
| ≤0.16 | Non-DRX requirements in clause 9.4.3.2 apply | Non-DRX requirements in clause 9.4.3.2 apply |
| 0.256 | 5.12\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | 7.68\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (30\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 0.32 | 6.4\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | 7.68\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (24\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 0.32< DRX-cycle ≤10.24 | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.3.2.  NOTE 3: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1  NOTE 4: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer. | | |

Table 9.4.3.3-2: Requirement to identify a newly detectable E-UTRAN TDD cell when *highSpeedMeasFlag-r16* is configured

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | TIdentify, E-UTRAN TDD (s) (DRX cycles) | |
|  | Gap/NCSG period = 40 ms, 20 ms | Gap/NCSG period = 80 ms |
| ≤0.16 | Non-DRX requirements in clause 9.4.3.2 apply | Non-DRX requirements in clause 9.4.3.2 apply |
| 0.16<DRx cycle<=0.32 | Note 1(15\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |  |
| 0.32<DRx cycle <= 0.64 | Note 1(10\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |  |
| DRx cycle = 1.024 | Note 1(10\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | Note 1(10\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| DRx cycle = 1.28 | Note 1(8\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | Note 1(8\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 1.28< DRX-cycle ≤10.24 | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.3.2.  NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[interRAT-MeasurementEnhancement-r16].*  NOTE 4: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1  NOTE 5: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer. | | |

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN TDD cells per E-UTRA TDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA TDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure, E-UTRAN TDD specified in Table 9.4.3.3-3.

Table 9.4.3.3-3: Requirement to measure E-UTRAN TDD cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure, E-UTRAN TDD (s) (DRX cycles) |
| ≤0.08 | Non-DRX Requirements in clause 9.4.3.2 apply |
| 0.128 | For configuration 2 Note3, non-DRX requirements in clause 9.4.3.2 apply,  Otherwise: Note1 (5\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 0.128<DRX-cycle≤10.24 | Note1 (5\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.3.2.  NOTE 3: See Table 9.4.3.2-1.  NOTE 4: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1 | |

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

#### 9.4.3.4 Measurement reporting requirements

##### 9.4.3.4.1 Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

##### 9.4.3.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.3.4.3.

##### 9.4.3.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

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 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 where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. 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 less than T Identify, E-UTRAN TDD defined in clauses 9.4.3.2 and 9.4.3.3 without DRX and with DRX, respectively.When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify, E-UTRAN TDD becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than TMeasure, E-UTRAN TDD provided the timing to that cell has not changed more than ± 50 Ts while measurement gap or NCSG has not been available and the L3 filter has not been used.

#### 9.4.3.5 Scheduling Availability During NR − E-UTRAN TDD measurements with NCSG

When UE supports *simultaneousRxTxInterBandENDC* for a band combination, no scheduling restriction is applicable to NR − E-UTRAN TDD measurements with NCSG in this band combination; otherwise UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within NCSG ML.

**-------------END OF CHANGE 19: 9.4.2/3 [R4-2317292] --------------**

**------------ START OF CHANGE 20: 9.4.v [R4-2317429/394] -------------**

### 9.4.v NR – E-UTRAN measurements without measurement gaps

#### 9.4.v.1 Introduction

The requirements in this clause are specified for NR−E-UTRAN FDD and NR−E-UTRAN TDD measurements and are applicable without an explicit E-UTRAN neighbour cell list containing physical layer cell identities, for a UE:

- in RRC\_CONNECTED state, and configured with SA with NR−E-UTRAN FDD or TDD measurement (RSRP, RSRQ, RS-SINR, RSTD, or E-CID RSRP and RSRQ) on E-UTRA frequency carrier

The inter-RAT EUTRA measurement requirements in this clause are applicable provided

- UE supports eutra-NeedForGapNCSG-reporting-r17 and indicating ‘nogap-noncsg’ in the E-UTRA band in NeedForGapNCSG-InfoEUTRA for inter-RAT EUTRA measurement, or

- UE supports [case b-2].

#### [9.4.v.2 Collision handling between EMW and MG/SMTC/SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement

If an NR – E-UTRAN measurement causes scheduling restriction as defined in clause 9.4.v.3.5 or 9.4.v.4.5, the measurement is performed within measurement gaps if one of the following conditions is met, and the requirements in clause 9.4.2 or 9.4.3 apply.

- EMW is configured and fully overlapped with measurement gap, and the periodicity of measurement gap and EMW is same, or

- EMW is not configured.

Otherwise, the measurement is performed within EMW occasions and requirements in clause 9.4.v apply.

When UE is configured with EMW and measurement gap, EMW and measurement gap occasions are considered colliding if the two occasions are fully or partially overlapping in time domain.

When UE is configured with EMW and SMTC/SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement, EMW and SMTC/SSB/CSI-RS occasions are considered colliding if the two occasions are fully or partially overlapping in time domain, provided that inter-RAT measurement during EMW would cause scheduling restriction.

In case of collision between EMW and measurement gap and EMW periodicity is smaller than MGRP, scheduling restriction specified in clause 9.4.x.x does not apply in the EMW occasions colliding with measurement gap.

[For case b-2], in case of collision between EMW and SMTC/SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement, scheduling restriction specified in clause 9.4.x.x does not apply in the EMW occasions colliding with measurement gap.]

Parameter TInter1 used in inter-RAT requirements in clause 9.4.v is defined based on Table 9.4.v.2-1:

Table 9.4.v.2-1 **[**the effective measurement window]

|  |  |  |  |
| --- | --- | --- | --- |
| **Configuration** | **[Effective measurement window periodicity] [ms]** | **[Effective measurement window duration] [ms]** | **Tinter1** |
| 0 | 40 | 5 | [60] |
| 1 | 80 | 5 | [30] |
| 2 | 40 | 2 | [24] |
| 3 | 80 | 2 | [12] |
| 4 | 40 | 5.5 | [60] |
| 5 | 80 | 5.5 | [30] |

### 9.4.v.3 NR − E-UTRAN FDD measurements

#### 9.4.v.3.1 Introduction

The requirements are applicable for NR−E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN FDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

- RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

- RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].

#### 9.4.v.3.2 Requirements when no DRX is used

The UE shall be able to identify a new detectable FDD cell within TIdentify, E-UTRAN FDD according to the following expression:

,

where:

TBasicIdentify = [480 ms],

TInter1 is defined in clause 9.4.v.1,

CSSFinterRAT = [TBD].

[Kp is the scaling factor due to overlapping between EMW and SMTC, measurement gap, or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement. Kp =1 if EMW is fully non-overlapped with SMTC, SSB/CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement and measurement gap. Otherwise, Kp = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

- For a window W of duration max(EMW period, SMTC period, MGRP, TSSB, TCSI-RS), where SMTC period follows smtc1 if high layer in TS 38.331 [2] signaling of smtc2 is not present on the same carrier frequency. Otherwise, SMTC period follows smtc2, TSSB/TCSI-RS is the periodicity of SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement on the same carrier frequency, and starting from the beginning of any SMTC occasion.

- Ntotal is the total number of EMW occasions within the window W, including those overlapped with SMTC, measurement gap, or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement, and

- Navailable is the number of EMW occasions that are not overlapped with any SMTC, measurement gap, or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement within the window W, after accounting for EMW collisions by applying the EMW collision rule in section 9.4.v.2.

- FFS: Kp = 1 when Navailable = 0.]

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure, E-UTRAN FDD defined in Table 9.4.v.3.2-1.

**Table 9.4.v.3.2-1:** M**easurement period and measurement bandwidth configuration**

|  |  |  |
| --- | --- | --- |
| **Configuration** | **Physical Layer Measurement period: Tmeasure, E-UTRAN FDD [ms]** | **Measurement bandwidth [RB]** |
| 0 | [TBD] | 6 |
| 1 (Note 1) | [TBD] | 50 |
| NOTE 1: This configuration is optional. | | |

When measurement gaps are scheduled for E-UTRAN FDD inter-RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement period Tmeasure, E-UTRAN FDD given by table 9.4.v.3.2-1.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

#### 9.4.v.3.3 Requirements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable E-UTRAN FDD cell within TIdentify, E-UTRAN FDD specified in Table 9.4.v.3.3-1.

Table 9.4.v.3.3-1: Requirement to identify a newly detectable E-UTRAN FDD cell

|  |  |  |
| --- | --- | --- |
| **DRX cycle length (s)** | **TIdentify, E-UTRAN FDD (s) (DRX cycles)** | |
|  | Gap/NCSG period = 40 ms, 20 ms | Gap/NCSG period = 80 ms |
| ≤0.16 | Non-DRX requirements in clause 9.4.2.2 apply | Non-DRX requirements in clause 9.4.2.2 apply |
| 0.256 | [TBD] | [TBD] |
| 0.32 | [TBD] | [TBD] |
| 0.32< DRX-cycle ≤10.24 | [TBD] | [TBD] |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.2.2.  NOTE 3: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1  NOTE 4: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer. | | |

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN FDD cells per E-UTRA FDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA FDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure, E-UTRAN FDD specified in Table 9.4.v.3.3-2.

**Table 9.4.v.3.3-2: Requirement to measure E-UTRAN FDD cells**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure, E-UTRAN FDD (s) (DRX cycles)** |
| ≤0.08 | [Non-DRX requirements in clause 9.4.v.2.2 apply] |
| 0.08< DRX-cycle ≤10.24 | [TBD] |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.v.3.2. | |

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

#### 9.4.v.3.4 Measurement reporting requirements

##### 9.4.v.3.4.1 Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

##### 9.4.v.3.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.v.3.4.3.

##### 9.4.v.3.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

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 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 where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. 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 less than T Identify, E-UTRAN FDD defined in clauses 9.4.v.3.2 and 9.4.v.3.3 without DRX and with DRX, respectively.When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify, E-UTRAN FDD becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than TMeasure, E-UTRAN FDD provided the timing to that cell has not changed more than ± 50 Ts while measurement gap or NCSG has not been available and the L3 filter has not been used.

#### 9.4.v.3.5 Scheduling availability during NR − E-UTRAN FDD measurements

When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction.

##### 9.4.v.3.5.1 Scheduling availability of UE performing inter-RAT measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

*Editor Notes: FFS the mix-numerology capability for scheduling restriction*

For UE which do not support [*interRATDiffNumerology]* [14] the following restrictions apply due to RSRP/RSRQ/SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on [all symbols within EMW duration].

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.

#### 9.4.v.4 NR − E-UTRAN TDD measurements

#### 9.4.v.4.1 Introduction

The requirements are applicable for NR−E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN TDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

- RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].

#### 9.4.v.4.2 Requirements when no DRX is used

The UE shall be able to identify a new detectable TDD cell within TIdentify, E-UTRAN TDD according to the following expression:

- When configuration 0 or configuration 1 in Table 9.4.v.4.2-1 is applied,

,

- When configuration 2 or configuration 3 in Table 9.4.v.4.2-1 is applied,

,

where:

TBasicIdentify = [480 ms],

TInter1 is defined in clause 9.4.v.1,

CSSFinterRAT = [TBD].

[Kp is the scaling factor due to overlapping between EMW and SMTC, measurement gap, or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement. Kp =1 if EMW is fully non-overlapped with SMTC, SSB/CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement and measurement gap. Otherwise, Kp = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

- For a window W of duration max(EMW period, SMTC period, MGRP, TSSB, TCSI-RS), where SMTC period follows smtc1 if high layer in TS 38.331 [2] signaling of smtc2 is not present on the same carrier frequency. Otherwise, SMTC period follows smtc2, TSSB/TCSI-RS is the periodicity of SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement on the same carrier frequency, and starting from the beginning of any SMTC occasion

- Ntotal is the total number of EMW occasions within the window, including those overlapped with SMTC, measurement gap, or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement, and

- Navailable is the number of EMW occasions that are not overlapped with any SMTC, measurement gap, or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement within the window W, after accounting for EMW collisions by applying the EMW collision rule in section 9.4.v.2.

- FFS: Kp = 1 when Navailable = 0.]

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasure, E-UTRAN TDD defined in Table 9.4.v.4.2-1.

Table 9.4.v.4.2-1: TMeasure, E-UTRAN TDD for different configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Configuration | Measurement bandwidth (RB) | Number of UL/DL sub-frames per half frame (5 ms) | | DwPTS | | TMeasure, E-UTRAN TDD (ms) |
|  |  | DL | UL | Normal CP | Extended CP |  |
| 0 | 6 | 2 | 2 |  |  | [480 x CSSFinterRAT] |
| 1 (Note 1) | 50 | 2 | 2 |  |  | [240 x CSSFinterRAT] |
| 2 | 6 | 1 | 3 |  |  | [720 x CSSFinterRAT] |
| 3 (Note 1) | 50 | 1 | 3 |  |  | [480 x CSSFinterRAT] |
| NOTE 1: This configuration is optional.  NOTE 2: Void | | | | | | |

When measurement gaps are scheduled for E-UTRAN TDD inter-RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement period Tmeasure, E-UTRAN TDD given by table 9.4.v.4.2-1.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

#### 9.4.v.4.3 Requirements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable E-UTRAN TDD cell within TIdentify, E-UTRAN TDD specified in Table 9.4.v.4.3-1.

Table 9.4.v.4.3-1: Requirement to identify a newly detectable E-UTRAN TDD cell

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | TIdentify, E-UTRAN TDD (s) (DRX cycles) | |
|  | Gap/NCSG period = 40 ms, 20 ms | Gap/NCSG period = 80 ms |
| ≤0.16 | Non-DRX requirements in clause 9.4.3.2 apply | Non-DRX requirements in clause 9.4.3.2 apply |
| 0.256 | [5.12\* CSSFinterRAT (20\*CSSFinterRAT)] | [7.68\* CSSFinterRAT (30\*CSSFinterRAT)] |
| 0.32 | [6.4\* CSSFinterRAT (20\*CSSFinterRAT)] | [7.68\* CSSFinterRAT (24\*CSSFinterRAT)] |
| 0.32< DRX-cycle ≤10.24 | Note1 (20\*CSSFinterRAT) | Note1 (20\*CSSFinterRAT) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.3.2.  NOTE 3: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1  NOTE 4: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer. | | |

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN TDD cells per E-UTRA TDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA TDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure, E-UTRAN TDD specified in Table 9.4.v.4.3-3.

Table 9.4.v.4.3-3: Requirement to measure E-UTRAN TDD cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure, E-UTRAN TDD (s) (DRX cycles) |
| ≤0.08 | [Non-DRX Requirements in clause 9.4.v.4.2 apply] |
| 0.128 | [For configuration 2 Note3, non-DRX requirements in clause 9.4.v.4.2 apply,]  Otherwise: [TBD] |
| 0.128<DRX-cycle≤10.24 | Note1 (5\*CSSFinterRAT) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.v.4.2.  NOTE 3: See Table 9.4.v.4.2-1. | |

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

#### 9.4.v.4.4 Measurement reporting requirements

##### 9.4.v.4.4.1 Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

##### 9.4.v.4.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.v.4.4.3.

##### 9.4.v.4.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

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 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 where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. 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 less than T Identify, E-UTRAN TDD defined in clauses 9.4.v.4.2 and 9.4.v.4.3 without DRX and with DRX, respectively.When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify, E-UTRAN TDD becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than TMeasure, E-UTRAN TDD provided the timing to that cell has not changed more than ± 50 Ts while measurement gap or NCSG has not been available and the L3 filter has not been used.

#### 9.4.v.4.5 Scheduling availability during NR − E-UTRAN TDD measurements

When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction.

##### 9.4.v.4.5.1 Scheduling availability of UE performing inter-RAT measurements in TDD bands on FR1

*Editor Notes: FFS the scheduling restriction will be applied to the whole EMW or with the symbols level.*

[When the UE performs inter-RAT measurements in a TDD band, the following restrictions apply due to RSRP, RS-SINR and RSRQ measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on [all symbols within EMW 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 TDD inter-band carrier aggregation is performed, 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.

##### [9.4.v.4.5.2 Scheduling availability of UE performing inter-RAT measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

*Editor Notes: FFS the mix-numerology capability for scheduling restriction*

For UE which do not support [*interRATDiffNumerology]* [14] the following restrictions apply due to RSRP/RSRQ/SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on [all symbols within EMW duration].

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 20: 9.4.v [R4-2317429/394] --------------**

**------------ START OF CHANGE 21: 9.5.4 [R4-2317295] --------------**

### 9.5.4 L1-RSRP measurement requirements

#### 9.5.4.1 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.

The value of TL1-RSRP\_Measurement\_Period\_SSB is defined in Table 9.5.4.1-1 for FR1. The value of TL1-RSRP\_Measurement\_Period\_SSB is defined in Table 9.5.4.1-2 for FR2 when *highSpeedMeasFlagFR2-r17* is not configured, and defined in Table 9.5.4.1-3 for FR2 power class 6 UE when *highSpeedMeasFlagFR2-r17* is configured, where

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

- N= 8 in Table 9.5.4.1-2.

For a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or 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 in FR1

- Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0

- Ntotal / Navailable in FR2 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 or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, 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 within the window W

- TL1 is periodicity of the target SSB.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s),

For FR1,

- 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 SSB; and

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

For FR2,

P1=, when SSB is not overlapped with measurement gap and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is PL1\_sharing\*Psharing factor, when SSB is not overlapped with measurement gap and SSB is fully overlapped with SMTC occasion (TSSB = TSMTCperiod).

- P1=, when SSB is partially overlapped with GAP and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with GAP and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TSSB < 0.5\*TSMTCperiod

- P is , when SSB is partially overlapped with GAP and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with GAP and TSMTCperiod = xRP and TSSB = 0.5\*TSMTCperiod

- P1=, when SSB is partially overlapped with GAP (TSSB < xRP) and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with GAP.

- P is , when SSB is partially overlapped with measurement gap and SSB is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with GAP (TSMTCperiod < xRP)

-

- If SSB resource from the cell with different PCI is configured for L1-RSRP measurement, and P2 is valid accoding to 9.13.4.1, and any symbol of the SSBs from serving cell and cell with different PCI are overlapping or adjacent (in time domain)

- P = , if P1\*TSSB < P2\*TSSB\_CDP.

- P = P1, if P1\*TSSB > P2\*TSSB\_CDP.

- P = 2\*P1, if P1\*TSSB = P2\*TSSB\_CDP.

- Otherwise, P = P1

Where:

- TSSB = ssb-periodicityServingCell of the serving cell

- TSMTCperiod = the configured SMTC period

- TSSB\_CDP = SSB periodicity of the cell with PCI different from serving cell

- Psharing factor = 1, if the SSB configured for L1-RSRP measurement outside gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

- PL1\_sharing = 2, if SSB resource from the cell with different PCI is configured for L1-RSRP measurement, and Psharing\_factor,CDP is used in 9.13.4.1, and any symbol of the SSBs from serving cell and cell with different PCI are overlapping or adjacent (in time domain). PL1\_sharing = 1, otherwise.

- TSSB = ssb-periodicityServingCell

- TSMTCperiod = the configured SMTC period

- When a measurement gap only is configured and the measurement gap is not NCSG,

- 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 UE is configured with Pre-MG, an SSB or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,

- an SSB or an SMTC occasion is considered to be overlapped with the GAP if

- it overlaps the VIL1 or VIL2 of NCSG, or

- it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

- and

- xRP = VIRP

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG measurement gap(s) are configured, an SSB or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

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*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and GAP configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer L1 RSRP measurement period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

Table 9.5.4.1-1: Measurement period TL1-RSRP\_Measurement\_Period\_SSB for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: 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.  Note 2: K = 1 when TSSB ≤ 40 ms and *highSpeedMeasFlag-r16 or highSpeedMeasCA-Scell-r17* are configured; otherwise K = 1.5.  Note 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16. or measurementEnhancementCA-r17* | |

Table 9.5.4.1-2: Measurement period TL1-RSRP\_Measurement\_Period\_SSB for FR2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*N)\*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. | |

Table 9.5.4.1-3: Measurement period TL1-RSRP\_Measurement\_Period\_SSB configured with *highSpeedMeasFlagFR2-r17* for FR2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N1Note2)\*TSSB) |
| DRX cycle ≤ 80ms | max(TReport, ceil(M\*P\*N1Note2\*M2)\*max(TDRX,TSSB)) |
| 80ms< DRX ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*N)\*TDRX |
| Note1: 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.  Note 2: Scaling factor N1 = 2 when *highSpeedMeasFlagFR2-r17* = set1or scaling factor N1 = 6 when *highSpeedMeasFlagFR2-r17* = [set2], if UE is not supporting [*simultaneousReceptionFR2HST-r18*] or when *highSpeedDeploymentTypeFR2-r17* is not configured as bidirectional. Scaling factor N1 = [TBD] when *highSpeedMeasFlagFR2-r17* is configured to set1 or scaling factor N1 = [4] when *highSpeedMeasFlagFR2-r17* is configured to set2, if UE is supporting [*simultaneousReceptionFR2HST-r18*] and when *highSpeedDeploymentTypeFR2-r17* is configured as bidirectional.  Note 3: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1 | |

#### 9.5.4.2 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.

The value of TL1-RSRP\_Measurement\_Period\_CSI-RS is defined in Table 9.5.4.2-1 for FR1 and in Table 9.5.4.2-2 for FR2, where

- 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 periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured with QCL-TypeD for all resources in the resource set.

- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided TCI state is provided with QCL-TypeD for all resources in the resource set in the MAC CE activating the resource set.

- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided *qcl-info* is configured for all resources in the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clause 10.1.19.2 and 10.1.20.2 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requirements apply provided *qcl-info* is configured with QCL-TypeD for all resources in the resource set.

For a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or 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

- Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0

- Ntotal / Navailable in FR2 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 or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, 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.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s),

For FR1,

- 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.

For FR2,

- P=1, when CSI-RS is not overlapped with a GAP and also not overlapped with SMTC occasion.

- P=, when CSI-RS is partially overlapped with GAP and CSI-RS is not overlapped with SMTC occasion (TCSI-RS < xRP)

- P=, when CSI-RS is not overlapped with GAP and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P=Psharing factor, when CSI-RS is not overlapped with GAP and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- P=1, when aperiodic CSI-RS resource is not overlapped with GAP

- P=, when CSI-RS is partially overlapped with GAP and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with GAP and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TCSI-RS < 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with GAP and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with GAP and TSMTCperiod = xRP and TCSI-RS = 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with GAP (TCSI-RS < xRP) and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with GAP.

- P=, when CSI-RS is partially overlapped with GAP and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with GAP (TSMTCperiod < xRP)

Where:

- Psharing factor = 1, if the CSI-RS configured for L1-RSRP measurement outside gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

TSMTCperiod = the configured SMTC period.

TCSI-RS = the periodicity of CSI-RS configured for L1-RSRP measurement

- When a measurement gap is configured only and the measurement gap is not NCSG,

- a CSI-RS or an SMTC occasion is considered to be as overlapped with the GAP if it overlapps a measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG, a CSI-RS or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,

- a CSI-RS or an SMTC occasion is considered to be as overlapped with the GAP if

- it overlaps the VIL1 or VIL2 of NCSG, or

- it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

- and

- xRP = VIRP

When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG measurement gap(s) are configured, a CSI-RS resource or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

Table 9.5.4.2-1: Measurement period TL1-RSRP\_Measurement\_Period\_CSI-RS for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_CSI-RS (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | 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.  Note 3: K = 1 when TCSI-RS ≤ 40 ms and *highSpeedMeasFlag-r16 or highSpeedMeasCA-Scell-r17* are configured; otherwise K = 1.5.  Note 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16 or measurementEnhancementCA-r17.* | |

Table 9.5.4.2-2: Measurement period TL1-RSRP\_Measurement\_Period\_CSI-RS for FR2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_CSI-RS (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P\*N)\*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. | |

**-------------END OF CHANGE 21: 9.5.4 [R4-2317295] --------------**

**------------ START OF CHANGE 22: 9.5A.4 [R4-2317295] --------------**

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

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

The value of TL1-RSRP\_Measurement\_Period\_SSB\_CCA is defined in Table 9.5A.4.1-1 for FR1, and in Table 9.5A.4.1-2 for FR2-2, where,

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

- N = TBD

For FR1, for a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

- P value for an 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 or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, 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 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

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s),

For FR1,

- 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 SSB; and

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

For FR2-2,

- P=, when SSB is not overlapped with measurement gap and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is Psharing factor, when SSB is not overlapped with measurement gap and SSB is fully overlapped with SMTC occasion (TSSB = TSMTCperiod).

- P=, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and

- TSMTCperiod ≠ MGRP or

- TSMTCperiod = MGRP and TSSB < 0.5\*TSMTCperiod

- P is , when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with measurement gap and TSMTCperiod = MGRP and TSSB = 0.5\*TSMTCperiod

- P=, when S SSB is partially overlapped with measurement gap (TSSB <MGRP) and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with measurement gap.

- P is , when SSB is partially overlapped with measurement gap and SSB is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with measurement gap (TSMTCperiod < MGRP)

Where:

- Psharing factor = 1, if the SSB configured for L1-RSRP measurement outside measurement gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,

- Psharing factor = 3, otherwise.

TSSB = ssb-periodicityServingCell

TSMTCperiod = the configured SMTC1 period or SMTC2 period if configured

- When a measurement gap only is configured,

- an SSB is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG, an SSB is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- When NCSG only is configured,

- an SSB is considered to be overlapped with the GAP if it overlaps the VIL1 or VIL2 of NCSG, and

- xRP = VIRP

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG measurement gap(s) are configured, an SSB or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

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 measurement gap configurations does not meet previous conditions.

UE shall report RSRP\_0 (Not valid) if L1>L1max, where L1 and L1max are defined in Table 9.5A.4.1-1.

Table 9.5A.4.1-1: Measurement period TL1-RSRP\_Measurement\_Period\_SSB\_CCA for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_CCA (ms) |
| non-DRX | max(TReport, ceil((M+L1)\*P)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*(M+L1)\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil((M+L1)\*P)\*TDRX |
| Note 1: 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.  Note 2: L1=0 if higher layer parameter timeRestrictionForChannelMeasurement is configured. Otherwise, when DRX is not configured L1 is the number of SSBs not available at the UE during TL1-RSRP\_Measurement\_Period\_SSB\_CCA, and when DRX is configured L1 is the number of DRX cycles in which at least one SSB is not available at the UE during TL1-RSRP\_Measurement\_Period\_SSB\_CCA, where L1 ≤ L1max. The UE is not required to determine the availability of SSB occasions more frequent than Once per Max(TReport, P \* TSSB) if no DRX is used,  Once per Max(TReport, Ceil(1.5 \* P) \* Max(TDRX, TSSB)) if DRX cycle ≤ 320ms,  Once per P \* TDRX if DRX cycle > 320ms.  Note 3: L1max =7 for Max(TDRX,TSSB) ≤ 40ms assuming TDRX=0 for non-DRX, L1max =5 for 40ms < Max(TDRX, TSSB) ≤ 320ms,  L1max =3 for TDRX > 320ms. | |

Table 9.5A.4.1-2: Measurement period TL1-RSRP\_Measurement\_Period\_SSB\_CCA for FR2-2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_CCA (ms) |
| non-DRX | max(TReport, ceil((M+L1)\*P\*N)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*(M+L1)\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(1.5\*(M+L1)\*P\*N)\*TDRX |
| Note 1: 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.  Note 2: L1=0 if higher layer parameter timeRestrictionForChannelMeasurement is configured. Otherwise, when DRX is not configured L1 is the number of SSB occasion groups not available at the UE during TL1-RSRP\_Measurement\_Period\_SSB\_CCA, where L1 ≤ L1max. An SSB occasions group consists of N consecutive SSB occasions, and the SSB occasions group is not available at the UE when at least one SSB occasion in the group is not transmitted by the gNB. When DRX is configured, L1 is the number of DRX cycle groups in which at least one SSB occasion is not available at the UE during TL1-RSRP\_Measurement\_Period\_SSB\_CCA, where L1 ≤ L1max. A DRX group consists of N DRX cycles, and the DRX cycle group is not available when there is at least one DRX in which at least one SSB occasion is not available. The UE is not required to determine the availability of SSB occasions more frequent than once per DRX cycle length, when configured with DRX.  Note 3: L1max =7 for Max(TDRX,TSSB) ≤ 40ms assuming TDRX=0 for non-DRX, L1max =5 for 40ms < Max(TDRX, TSSB) ≤ 320ms,  L1max =3 for TDRX > 320ms. | |

**-------------END OF CHANGE 22: 9.5A.4 [R4-2317295] --------------**

**------------ START OF CHANGE 23: 9.8.4 [R4-2317295] --------------**

### 9.8.4 L1-SINR measurement requirements

#### 9.8.4.1 L1-SINR reporting with CSI-RS based CMR and no dedicated IMR configured

edicated 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.

The value of TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only is defined in Table 9.8.4.1-1 for FR1 and in Table 9.8.4.1-2 for FR2, 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 the value of N in FR2

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured for all resources in the resource set.

- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set.

- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requriements apply provided *qcl-info* is configured for all resources in the resource set and for each resource has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clause 10.1.28.1 and 10.1.28.3 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requriements apply provided *qcl-info* is configured for all resources in the resource set.

For a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or 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

- Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0

- Ntotal / Navailable in FR2 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 or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, 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.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *[support for Case 1 requirements]* nor *[support for Case 2 requirements]* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s),

For the value of P in FR1,

- P=, when in the monitored cell there are GAP 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.

For the value of P in FR2,

- P=1, when CSI-RS is not overlapped with GAP and also not overlapped with SMTC occasion.

- P=, when CSI-RS is partially overlapped with GAP and CSI-RS is not overlapped with SMTC occasion (TCSI-RS < xRP)

- P=, when CSI-RS is not overlapped with GAP and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P is Psharing factor,, when CSI-RS is not overlapped with GAP and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- P=, when CSI-RS is partially overlapped with [measurement gap] and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with GAP and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TCSI-RS < 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with GAP and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with GAP and TSMTCperiod = xRP and TCSI-RS = 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with GAP (TCSI-RS < xRP) and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with GAP.

- P=, when CSI-RS is partially overlapped with GAP and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with GAP (TSMTCperiod < xRP)

Where:

Psharing factor = 1, if the CSI-RS configured for L1-SINR measurement outside gap is

not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

- TSMTCperiod = the configured SMTC1 period or SMTC2 period if configured.

- TCSI-RS = the periodicity of CSI-RS configured for L1-SINR measurement

- When a measurement gap only is configured and the measurement gap is not NCSG,

- a CSI-RS is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

- If the UE is configured with Pre-MG, a CSI-RS reourse or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,

- a CSI-RS is considered to be overlapped with the GAP if

- it overlaps the VIL1 or VIL2 of NCSG, or

- it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

- and

- xRP = VIRP

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG measurement gap(s) are configured, a CSI-RS resource or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

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 pervious conditions.

Table 9.8.4.1-1: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only for FR1

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | 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. | |

Table 9.8.4.1-2: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only for FR2

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P\*N)\*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. | |

**-------------END OF CHANGE 23: 9.8.4 [R4-2317295] --------------**