**3GPP TSG- Meeting #**

**Bengaluru, , –**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** | **1** | **Current version:** |  |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:***  |  |
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| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | NR\_ATG\_enh-Core |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** |  |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
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| ***Reason for change:*** | Update the requirements for L1-RSRP measurements for Reporting for ATG CA based on agreements of RAN4#115 on top of endorsed draft Big CR (R4-2508454). |
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| ***Summary of change:*** | The requirements for L1-RSRP measurements for Reporting for ATG CA were added based on the agreements. - update condition of Navailable for P value in 9.5D.4 |
|  |  |
| ***Consequences if not approved:*** | The core requirements for ATG CA will be missed. |
|  |  |
| ***Clauses affected:*** | 9.5D.1, 9.5D.4, 9.5D.6 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS38.533  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

-------------- Start of Change <1> --------------

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

### 9.5D.1 Introduction

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

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

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

-------------- End of Change <1> --------------

-------------- Start of Change <2> --------------

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

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

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

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

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

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

P value for SSB resource to be measured is defined as

- Ntotal / Navailable with Navailable > 0

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

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

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

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

- Navailable is

- if the measured carrier is the SCC with *servingcellMO* configured, and the network indication *skippingSCCneighborCellMeas* is set to ‘enable’ to UE

- if inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams

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

- otherwise,

- the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements of other serving cell within the window W

- otherwise,

- if inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams

- the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements of same serving cell within the window W

- otherwise,

- the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements within the window W

- TL1 is periodicity of the target SSB

- Psharing factor = 3.

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

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

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

- Ntotal / Noutside\_MG

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

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

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

- TL1 is periodicity of the target SSB.

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

- P=$\frac{1}{1-\frac{T\_{SSB}}{xGP}}$, when in the monitored cell there are GAPs configured for intra-frequency or inter-frequency, which are overlapping with some but not all occasions of the SSB; and

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

Where:

- TSSB = *ssb-periodicityServingCell* of the serving cell

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

- xRP = MGRP

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*.

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

Table 9.5D.4.1-1: Measurement period TL1-RSRP\_Measurement\_Period\_SSB\_ATG for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_ATG (ms)  |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320 ms | ceil(M\*P)\*TDRX |
| NOTE: TSSB = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting. |

#### 9.5D.4.2 CSI-RS based L1-RSRP Reporting

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

- For periodic and semi-persistent CSI-RS resources, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

- For aperiodic CSI-RS resources M=1

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

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

- Ntotal / Navailable with Navailable > 0

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

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

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

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

- Navailable is

- if the measured carrier is the SCC with *servingcellMO* configured, and the network indication *skippingSCCneighborCellMeas* is set to ‘enable’ to UE,

- if inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams

- the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- otherwise,

- the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements of other serving cell within the window W

- otherwise,

- if inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams

- the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements of same serving cell within the window W

- otherwise,

- the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements within the window W

- TL1 is periodicity of the target CSI-RS

- Psharing factor = 3.

Otherwise, for UE with one or multiple omni-directional antenna(s)

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

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

- Ntotal / Noutside\_MG in FR1

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

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

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

TL1 is periodicity of the target CSI-RS.

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

- P=$\frac{1}{1-\frac{T\_{CSI-RS}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

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

Where:

TCSI-RS = the periodicity of CSI-RS configured for L1-RSRP measurement

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

- xRP = MGRP

Table 9.5D.4.2-1: Measurement period TL1-RSRP\_Measurement\_Period\_CSI-RS\_ATG for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_CSI-RS\_ATG (ms)  |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320 ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320 ms | ceil(M\*P)\*TDRX |
| NOTE 1: TCSI-RS is the periodicity of CSI-RS configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3. |

-------------- End of Change <2> --------------

-------------- Start of Change <3> --------------

### 9.5D.6 Scheduling availability of UE during L1-RSRP measurement

Scheduling availability restrictions described in the following clauses apply when the UE is performing L1-RSRP measurement on serving cell, and UE is receiving PDCCH/PDSCH from serving cell and/or cell(s) with different PCI.

#### 9.5D.6.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

#### 9.5D.6.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

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

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on serving cell where L1-RSRP measurement is performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which the serving cell where L1-RSRP measurement is performed is configured.

-------------- End of Change <3> --------------