**3GPP TSG-RAN WG2 #128 *R2-2411225***

**Orlando, USA, November 18th - 22th 2024**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  | **38.331** | **CR** |  **5128** | **rev** | **1** | **Current version:** | **16.18.0** |  |
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| *For* [***HELP***](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 | **X** | Core Network |  |

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|  |
| ***Title:***  | Miscellaneous non-controversial corrections Set XXIII |
|  |  |
| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_newRAT-Core, TEI16 |  | ***Date:*** | 2024-11-26 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
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| ***Reason for change:*** | Correction of miscellaneous non-controversial errors (typos etc). |
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| ***Summary of change:*** | 1. In SIB2, need code for *t-ReselectionNR-SF* is changed from Need N (“Upon receiving message with the field absent, the UE takes no action”) to Need S. UE behaviour upon absence of the field is captured in field description with reference to TS 38.304 (no multiplication of TreselectionNR with scaling factor will take place).Need S is also used for *t-ReselectionEUTRA-SF* in SIB5.

**CRs agreed to be merged at RAN2#127bis:**1. R2-2408246 Minor Corrections on TS38.331Deleted redundant text in 5.5.3.1.For events A3, A4, A5, A6, B1, B2, added that offsets refer to the frequency of the neighbour cell.
2. R2-2408810 Correction to Ocn description in measurement eventCorrected in 5.5.4.5 (Event A4) that Ocn is a cell specific offset.
3. R2-2408889 RRC correction on field descriptions of PUSCH-ServingCellConfigCorrected references to TS 38.214 for fields *codeBlockGroupTransmission* and *xOverhead*. In *xOverhead* field description, changed *'xoh0'* ´to “0”, since *'xoh0'* is not defined.

**CRs agreed to be merged at RAN2#128**1. R2-2410074 Correction on protection of RRC messagesAdded *IABOtherInformation* and *LoggedMeasurementConfiguration* to table in B.1 Protection of RRC messages.

**Impact analysis**Impacted 5G architecture options: NR SA, (NG)EN-DC, NE-DC, NR-DCImpacted functionality: MiscellaneousInter-operability:There are no interoperability issues. |
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| ***Consequences if not approved:*** | Miscellaneous typos and editorials will remain in the specification. |
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| ***Clauses affected:*** | 5.5.3.1, 5.5.4.4, 5.5.4.5, 5.5.4.6, 5.5.4.7, 5.5.4.8, 5.5.4.9, 6.3.1, 6.3.2, B.1 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **N** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **N** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **N** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | R2-2409998 |

#### 5.5.3.1 General

An RRC\_CONNECTED UE shall derive cell measurement results by measuring one or multiple beams associated per cell as configured by the network, as described in 5.5.3.3. For all cell measurement results, except for RSSI, and CLI measurement results in RRC\_CONNECTED, the UE applies the layer 3 filtering as specified in 5.5.3.2, before using the measured results for evaluation of reporting criteria, measurement reporting or the criteria to trigger conditional reconfiguration execution. For cell measurements, the network can configure RSRP, RSRQ, SINR, RSCP or EcN0 as trigger quantity. For CLI measurements, the network can configure SRS-RSRP or CLI-RSSI as trigger quantity. For cell and beam measurements, reporting quantities can be any combination of quantities (i.e. only RSRP; only RSRQ; only SINR; RSRP and RSRQ; RSRP and SINR; RSRQ and SINR; RSRP, RSRQ and SINR; only RSCP; only EcN0; RSCP and EcN0), irrespective of the trigger quantity, and for CLI measurements, reporting quantities can be either SRS-RSRP or CLI-RSSI. For conditional reconfiguration execution, the network can configure up to 2 quantities, both using same RS type. The UE does not apply the layer 3 filtering as specified in 5.5.3.2 to derive the CBR measurements.

The network may also configure the UE to report measurement information per beam (which can either be measurement results per beam with respective beam identifier(s) or only beam identifier(s)), derived as described in 5.5.3.3a. If beam measurement information is configured to be included in measurement reports, the UE applies the layer 3 beam filtering as specified in 5.5.3.2. On the other hand, the exact L1 filtering of beam measurements used to derive cell measurement results is implementation dependent.

The UE shall:

1> whenever the UE has a *measConfig*, perform RSRP and RSRQ measurements for each serving cell for which *servingCellMO* is configured as follows:

2> if the *reportConfig* associated with at least one *measId* included in the *measIdList* within *VarMeasConfig* contains an *rsType* set to *ssb* and *ssb-ConfigMobility* is configured in the *measObject* indicated by the *servingCellMO*:

3> if the *reportConfig* contains a *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport*:

4> derive layer 3 filtered RSRP and RSRQ per beam for the serving cell based on SS/PBCH block, as described in 5.5.3.3a;

3> derive serving cell measurement results based on SS/PBCH block, as described in 5.5.3.3;

2> if the *reportConfig* associated with at least one *measId* included in the *measIdList* within *VarMeasConfig* contains an *rsType* set to *csi-rs* and *CSI-RS-ResourceConfigMobility* is configured in the *measObject* indicated by the *servingCellMO*:

3> if the *reportConfig* contains a *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport*:

4> derive layer 3 filtered RSRP and RSRQ per beam for the serving cell based on CSI-RS, as described in 5.5.3.3a;

3> derive serving cell measurement results based on CSI-RS, as described in 5.5.3.3;

1> for each serving cell for which *servingCellMO* is configured, if the *reportConfig* associated with at least one *measId* included in the *measIdList* within *VarMeasConfig* contains SINR as trigger quantity and/or reporting quantity:

2> if the *reportConfig* contains *rsType* set to *ssb* and *ssb-ConfigMobility* is configured in the *servingCellMO*:

3> if the *reportConfig*contains a *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport*:

4> derive layer 3 filtered SINR per beam for the serving cell based on SS/PBCH block, as described in 5.5.3.3a;

3> derive serving cell SINR based on SS/PBCH block, as described in 5.5.3.3;

2> if the *reportConfig* contains *rsType* set to *csi-rs* and *CSI-RS-ResourceConfigMobility* is configured in the *servingCellMO*:

3> if the *reportConfig*contains a *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport*:

4> derive layer 3 filtered SINR per beam for the serving cell based on CSI-RS, as described in 5.5.3.3a;

3> derive serving cell SINR based on CSI-RS, as described in 5.5.3.3;

1> for each *measId* included in the *measIdList* within *VarMeasConfig*:

2> if the *reportType* for the associated *reportConfig* is set to *reportCGI* and timer T321 is running:

3> if *useAutonomousGaps* is configured for the associated *reportConfig*:

4> perform the corresponding measurements on the frequency and RAT indicated in the associated *measObject* using autonomous gaps as necessary;

3> else:

4> perform the corresponding measurements on the frequency and RAT indicated in the associated *measObject* using available idle periods;

3> if the cell indicated by *reportCGI* field for the associated *measObject* is an NR cell and that indicated cell is broadcasting *SIB1* (see TS 38.213 [13], clause 13):

4> try to acquire *SIB1* in the concerned cell;

3> if the cell indicated by *reportCGI* field is an E-UTRA cell:

4> try to acquire *SystemInformationBlockType1* in the concerned cell;

2> if the *ul-DelayValueConfig* is configured for the associated *reportConfig*:

3> ignore the *measObject;*

3> for each of the configured DRBs*,* configure the PDCP layer to perform corresponding average UL PDCP packet delay measurement per DRB;

2> if the *reportType* for the associated *reportConfig* is *periodical*, *eventTriggered* or *condTriggerConfig*:

3> if a measurement gap configuration is setup, or

3> if the UE does not require measurement gaps to perform the concerned measurements:

4> if *s-MeasureConfig* is not configured, or

4> if *s-MeasureConfig* is set to *ssb-RSRP* and the NR SpCell RSRP based on SS/PBCH block, after layer 3 filtering, is lower than *ssb-RSRP,* or

4> if *s-MeasureConfig* is set to *csi-RSRP* and the NR SpCell RSRP based on CSI-RS, after layer 3 filtering, is lower than *csi-RSRP*:

5> if the *measObject* is associated to NR and the *rsType* is set to *csi-rs*:

6> if reportQuantityRS-Indexes and maxNrofRS-IndexesToReport for the associated reportConfig are configured:

7> derive layer 3 filtered beam measurements only based on CSI-RS for each measurement quantity indicated in *reportQuantityRS-Indexes*, as described in 5.5.3.3a;

6> derive cell measurement results based on CSI-RS for the trigger quantity and each measurement quantity indicated in *reportQuantityCell* using parameters from the associated *measObject*, as described in 5.5.3.3;

5> if the *measObject* is associated to NR and the *rsType* is set to *ssb*:

6> if reportQuantityRS-Indexes and maxNrofRS-IndexesToReport for the associated reportConfig are configured:

7> derive layer 3 beam measurements only based on SS/PBCH block for each measurement quantity indicated in *reportQuantityRS-Indexes*, as described in 5.5.3.3a;

6> derive cell measurement results based on SS/PBCH block for the trigger quantity and each measurement quantity indicated in *reportQuantityCell* using parameters from the associated *measObject*, as described in 5.5.3.3;

5> if the *measObject* is associated to E-UTRA:

6> perform the corresponding measurements associated to neighbouring cells on the frequencies indicated in the concerned *measObject*, as described in 5.5.3.2;

5> if the measObject is associated to UTRA-FDD:

6> perform the corresponding measurements associated to neighbouring cells on the frequencies indicated in the concerned *measObject*, as described in 5.5.3.2;

4> if the *measRSSI-ReportConfig* is configured in the associated *reportConfig*:

5> perform the RSSI and channel occupancy measurements on the frequency configured by *rmtc-Frequency* in the associated *measObject*;

2> if the *reportType* for the associated *reportConfig* is set to *reportSFTD* and the *numberOfReportsSent* as defined within the *VarMeasReportList* for this *measId* is less than one:

3> if the *reportSFTD-Meas* is set to *true:*

4> if the *measObject* is associated to E-UTRA:

5> perform SFTD measurements between the PCell and the E-UTRA PSCell;

5> if the *reportRSRP* is set to *true*;

6> perform RSRP measurements for the E-UTRA PSCell;

4> else if the *measObject* is associated to NR:

5> perform SFTD measurements between the PCell and the NR PSCell;

5> if the *reportRSRP* is set to *true*;

6> perform RSRP measurements for the NR PSCell based on SSB;

3> else if the *reportSFTD-NeighMeas* is included*:*

4> if the *measObject* is associated to NR:

5> if the *drx-SFTD-NeighMeas* is included:

6> perform SFTD measurements between the PCell and the NR neighbouring cell(s) detected based on parameters in the associated *measObject* using available idle periods;

5> else:

6> perform SFTD measurements between the PCell and the NR neighbouring cell(s) detected based on parameters in the associated *measObject*;

5> if the *reportRSRP* is set to *true*:

6> perform RSRP measurements based on SSB for the NR neighbouring cell(s) detected based on parameters in the associated *measObject*;

2> if the *reportType* for the associated *reportConfig* is *cli-Periodical* or *cli-EventTriggered*:

3> perform the corresponding measurements associated to CLI measurement resources indicated in the concerned *measObjectCLI*;

2> perform the evaluation of reporting criteria as specified in 5.5.4, except if *reportConfig* is *condTriggerConfig*.

NOTE 1: The evaluation of conditional reconfiguration execution criteria is specified in 5.3.5.13.

The UE capable of CBR measurement when configured to transmit NR sidelink communication shall:

1> If the frequency used for NR sidelink communication is included in *sl-FreqInfoToAddModList* in *sl-ConfigDedicatedNR* within *RRCReconfiguration* message or includedin *sl-ConfigCommonNR* within *SIB12*:

2> if the UE is in RRC\_IDLE or in RRC\_INACTIVE:

3> if the cell chosen for NR sidelink communication provides *SIB12* which includes *sl-TxPoolSelectedNormal* or *sl-TxPoolExceptional* forthe concerned frequency:

4> perform CBR measurement on pool(s) in *sl-TxPoolSelectedNormal* or *sl-TxPoolExceptional* for the concerned frequency in *SIB12*;

2> if the UE is in RRC\_CONNECTED:

3> if *tx-PoolMeasToAddModList* is included in *VarMeasConfig*:

4> perform CBR measurements on each transmission resource pool indicated in the *tx-PoolMeasToAddModList*;

3> if *sl-TxPoolSelectedNormal*, *sl-TxPoolScheduling* or *sl-TxPoolExceptional* is included in *sl-ConfigDedicatedNR* for the concerned frequency within *RRCReconfiguration*:

4> perform CBR measurement on pool(s) in *sl-TxPoolSelectedNormal*, *sl-TxPoolScheduling* or *sl-TxPoolExceptional* if included in *sl-ConfigDedicatedNR* for the concerned frequency within *RRCReconfiguration*;

3> else if the cell chosen for NR sidelink communication provides *SIB12* which includes *sl-TxPoolSelectedNormal* or *sl-TxPoolExceptional* forthe concerned frequency:

4> perform CBR measurement on pool(s) in *sl-TxPoolSelectedNormal* or *sl-TxPoolExceptional* for the concerned frequency in *SIB12*;

1> else:

2> perform CBR measurement on pool(s) in *sl-TxPoolSelectedNormal* in *SidelinkPreconfigNR* for the concerned frequency.

NOTE 2: In case the configurations for NR sidelink communication and CBR measurement are acquired via the E-UTRA, configurations for NR sidelink communication in *SIB12*, *sl-ConfigDedicatedNR* within *RRCReconfiguration* used in this clause are provided by the configurations in *SystemInformationBlockType28*, *sl-ConfigDedicatedForNR* within *RRCConnectionReconfiguration* as specified in TS 36.331[10], respectively.

NOTE 3: If a UE that is configured by upper layers to transmit V2X sidelink communication is configured by NR with transmission resource pool(s) and the measurement objects concerning V2X sidelink communication (i.e. by *sl-ConfigDedicatedEUTRA-Info*), it shall perform CBR measurement as specified in clause 5.5.3 of TS 36.331 [10], based on the transmission resource pool(s) and the measurement object(s) concerning V2X sidelink communication configured by NR.

NOTE 4: For V2X sidelink communication, each of the CBR measurement results is associated with a resource pool, as indicated by the *poolReportId* (see TS 36.331 [10]), that refers to a pool as included in *sl-ConfigDedicatedEUTRA-Info* or *SIB13*.

#### 5.5.4.4 Event A3 (Neighbour becomes offset better than SpCell)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition A3-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A3-2, as specified below, is fulfilled;

1> use the SpCell for *Mp*, *Ofp and Ocp*.

NOTE 1: The cell(s) that triggers the event has reference signals indicated in the *measObjectNR* associated to this event which may be different from the NR SpCell *measObjectNR*.

Inequality A3-1 (Entering condition)

*Mn + Ofn + Ocn – Hys > Mp + Ofp + Ocp + Off*

Inequality A3-2 (Leaving condition)

*Mn + Ofn + Ocn + Hys < Mp + Ofp + Ocp + Off*

The variables in the formula are defined as follows:

***Mn*** is the measurement result of the neighbouring cell, not taking into account any offsets.

***Ofn*** is the measurement object specific offset of the reference signal of the neighbour cell (i.e. *offsetMO* as defined within *measObjectNR* corresponding to the frequency of the neighbour cell).

***Ocn*** is the cell specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within *measObjectNR* corresponding to the frequency of the neighbour cell), and set to zero if not configured for the neighbour cell.

***Mp*** is the measurement result of the SpCell, not taking into account any offsets.

***Ofp*** is the measurement object specific offset of the SpCell (i.e. *offsetMO* as defined within *measObjectNR* corresponding to the SpCell).

***Ocp*** is the cell specific offset of the SpCell (i.e. *cellIndividualOffset* as defined within *measObjectNR* corresponding to the SpCell), and is set to zero if not configured for the SpCell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event).

***Off*** is the offset parameter for this event (i.e. *a3-Offset* as defined within *reportConfigNR* for this event).

***Mn, Mp*** are expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

***Ofn***, ***Ocn***, ***Ofp***, ***Ocp***, ***Hys***, ***Off*** are expressed in dB.

NOTE 2: The definition of Event A3 also applies to CondEvent A3.

#### 5.5.4.5 Event A4 (Neighbour becomes better than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition A4-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A4-2, as specified below, is fulfilled.

Inequality A4-1 (Entering condition)

*Mn + Ofn + Ocn – Hys > Thresh*

Inequality A4-2 (Leaving condition)

*Mn + Ofn + Ocn + Hys < Thresh*

The variables in the formula are defined as follows:

***Mn*** is the measurement result of the neighbouring cell, not taking into account any offsets.

***Ofn*** is the measurement object specific offset of the neighbour cell (i.e. *offsetMO* as defined within *measObjectNR* corresponding to the frequency of the neighbour cell).

***Ocn*** is the cell specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within *measObjectNR* corresponding to the frequency of the neighbour cell), and set to zero if not configured for the neighbour cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *a4-Threshold* as defined within *reportConfigNR* for this event).

***Mn*** is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

***Ofn, Ocn, Hys*** are expressed in dB.

***Thresh*** is expressed in the same unit as ***Mn***.

#### 5.5.4.6 Event A5 (SpCell becomes worse than threshold1 and neighbour becomes better than threshold2)

The UE shall:

1> consider the entering condition for this event to be satisfied when both condition A5-1 and condition A5-2, as specified below, are fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A5-3 or condition A5-4, i.e. at least one of the two, as specified below, is fulfilled;

1> use the SpCell for *Mp*.

NOTE 1: The parameters of the reference signal(s) of the cell(s) that triggers the event are indicated in the *measObjectNR* associated to the event which may be different from the *measObjectNR* of the NR SpCell.

Inequality A5-1 (Entering condition 1)

*Mp + Hys < Thresh1*

Inequality A5-2 (Entering condition 2)

*Mn + Ofn + Ocn – Hys > Thresh2*

Inequality A5-3 (Leaving condition 1)

*Mp – Hys > Thresh1*

Inequality A5-4 (Leaving condition 2)

*Mn + Ofn + Ocn + Hys < Thresh2*

The variables in the formula are defined as follows:

***Mp*** is the measurement result of the NR SpCell, not taking into account any offsets.

***Mn*** is the measurement result of the neighbouring cell, not taking into account any offsets.

***Ofn*** is the measurement object specific offset of the neighbour cell (i.e. *offsetMO* as defined within *measObjectNR* corresponding to the frequency of the neighbour cell).

***Ocn*** is the cell specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within *measObjectNR* corresponding to the frequency of the neighbour cell), and set to zero if not configured for the neighbour cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event).

***Thresh1*** is the threshold parameter for this event (i.e. *a5-Threshold1* as defined within *reportConfigNR* for this event).

***Thresh2*** is the threshold parameter for this event (i.e. *a5-Threshold2* as defined within *reportConfigNR* for this event).

***Mn, Mp*** are expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

***Ofn, Ocn, Hys*** are expressed in dB.

***Thresh1***is expressed in the same unit as ***Mp***.

***Thresh2*** is expressed in the same unit as ***Mn***.

NOTE 2: The definition of Event A5 also applies to CondEvent A5.

#### 5.5.4.7 Event A6 (Neighbour becomes offset better than SCell)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition A6-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A6-2, as specified below, is fulfilled;

1> for this measurement, consider the (secondary) cell corresponding to the *measObjectNR* associated to this event to be the serving cell.

NOTE: The reference signal(s) of the neighbour(s) and the reference signal(s) of the SCell are both indicated in the associated *measObjectNR*.

Inequality A6-1 (Entering condition)

*Mn + Ocn – Hys > Ms + Ocs + Off*

Inequality A6-2 (Leaving condition)

*Mn + Ocn + Hys < Ms + Ocs + Off*

The variables in the formula are defined as follows:

***Mn*** is the measurement result of the neighbouring cell, not taking into account any offsets.

***Ocn*** is the cell specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within the associated *measObjectNR* corresponding to the frequency of the neighbour cell), and set to zero if not configured for the neighbour cell.

***Ms*** is the measurement result of the serving cell, not taking into account any offsets.

***Ocs*** is the cell specific offset of the serving cell (i.e. *cellIndividualOffset* as defined within the associated *measObjectNR*), and is set to zero if not configured for the serving cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event).

***Off*** is the offset parameter for this event (i.e. *a6-Offset* as defined within *reportConfigNR* for this event).

***Mn, Ms*** are expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

***Ocn, Ocs, Hys, Off*** are expressed in dB.

#### 5.5.4.8 Event B1 (Inter RAT neighbour becomes better than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition B1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition B1-2, as specified below, is fulfilled.

Inequality B1-1 (Entering condition)

*Mn + Ofn + Ocn – Hys > Thresh*

Inequality B1-2 (Leaving condition)

*Mn + Ofn + Ocn + Hys < Thresh*

The variables in the formula are defined as follows:

***Mn*** is the measurement result of the inter-RAT neighbour cell, not taking into account any offsets.

***Ofn*** is the measurement object specific offset of the frequency of the inter-RAT neighbour cell (i.e. *eutra-Q-OffsetRange* as defined within the *measObjectEUTRA* corresponding to the frequency of the neighbour inter-RAT cell, *utra-FDD-Q-OffsetRange* as defined within the *measObjectUTRA-FDD* corresponding to the frequency of the neighbour inter-RAT cell).

***Ocn*** is the cell specific offset of the inter-RAT neighbour cell (i.e. *cellIndividualOffset* as defined within the *measObjectEUTRA* corresponding to the frequency of the neighbour inter-RAT cell), and set to zero if not configured for the neighbour cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigInterRAT* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *b1-ThresholdEUTRA* as defined within *reportConfigInterRAT* for this event, *b1-ThresholdUTRA-FDD* as defined for UTRA-FDD within *reportConfigInterRAT* for this event).

***Mn*** is expressed in dBm or in dB, depending on the measurement quantity of the inter-RAT neighbour cell.

***Ofn, Ocn, Hys*** are expressed in dB.

***Thresh*** is expressed in the same unit as ***Mn***.

#### 5.5.4.9 Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2)

The UE shall:

1> consider the entering condition for this event to be satisfied when both condition B2-1 and condition B2-2, as specified below, are fulfilled;

1> consider the leaving condition for this event to be satisfied when condition B2-3 or condition B2-4, i.e. at least one of the two, as specified below, is fulfilled;

Inequality B2-1 (Entering condition 1)

*Mp + Hys < Thresh1*

Inequality B2-2 (Entering condition 2)

*Mn + Ofn + Ocn – Hys > Thresh2*

Inequality B2-3 (Leaving condition 1)

*Mp – Hys > Thresh1*

Inequality B2-4 (Leaving condition 2)

*Mn + Ofn + Ocn + Hys < Thresh2*

The variables in the formula are defined as follows:

***Mp*** is the measurement result of the PCell, not taking into account any offsets.

***Mn*** is the measurement result of the inter-RAT neighbour cell, not taking into account any offsets.

***Ofn*** is the measurement object specific offset of the frequency of the inter-RAT neighbour cell (i.e. *eutra-Q-OffsetRange* as defined within the *measObjectEUTRA* corresponding to the frequency of the inter-RAT neighbour cell, *utra-FDD-Q-OffsetRange* as defined within the *measObjectUTRA-FDD* corresponding to the frequency of the neighbour inter-RAT cell).

***Ocn*** is the cell specific offset of the inter-RAT neighbour cell (i.e. *cellIndividualOffset* as defined within the *measObjectEUTRA* corresponding to the frequency of the neighbour inter-RAT cell), and set to zero if not configured for the neighbour cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigInterRAT* for this event).

***Thresh1*** is the threshold parameter for this event (i.e. b2*-Threshold1* as defined within *reportConfigInterRAT* for this event).

***Thresh2*** is the threshold parameter for this event (i.e. *b2-Threshold2EUTRA* as defined within *reportConfigInterRAT* for this event, *b2-Threshold2UTRA-FDD* as defined for UTRA-FDD within *reportConfigInterRAT* for this event).

***Mp*** is expressed in dBm in case of RSRP, or in dB in case of RSRQ and SINR.

***Mn*** is expressed in dBm or dB, depending on the measurement quantity of the inter-RAT neighbour cell.

***Ofn, Ocn, Hys*** are expressed in dB.

***Thresh1*** is expressed in the same unit as ***Mp***.

***Thresh2*** is expressed in the same unit as ***Mn***.

### 6.3.1 System information blocks

#### – *SIB2*

*SIB2* contains cell re-selection information common for intra-frequency, inter-frequency and/or inter-RAT cell re-selection (i.e. applicable for more than one type of cell re-selection but not necessarily all) as well as intra-frequency cell re-selection information other than neighbouring cell related.

*SIB2* information element

-- ASN1START

-- TAG-SIB2-START

SIB2 ::= SEQUENCE {

 cellReselectionInfoCommon SEQUENCE {

 nrofSS-BlocksToAverage INTEGER (2..maxNrofSS-BlocksToAverage) OPTIONAL, -- Need S

 absThreshSS-BlocksConsolidation ThresholdNR OPTIONAL, -- Need S

 rangeToBestCell RangeToBestCell OPTIONAL, -- Need R

 q-Hyst ENUMERATED {

 dB0, dB1, dB2, dB3, dB4, dB5, dB6, dB8, dB10,

 dB12, dB14, dB16, dB18, dB20, dB22, dB24},

 speedStateReselectionPars SEQUENCE {

 mobilityStateParameters MobilityStateParameters,

 q-HystSF SEQUENCE {

 sf-Medium ENUMERATED {dB-6, dB-4, dB-2, dB0},

 sf-High ENUMERATED {dB-6, dB-4, dB-2, dB0}

 }

 } OPTIONAL, -- Need R

 ...

 },

 cellReselectionServingFreqInfo SEQUENCE {

 s-NonIntraSearchP ReselectionThreshold OPTIONAL, -- Need S

 s-NonIntraSearchQ ReselectionThresholdQ OPTIONAL, -- Need S

 threshServingLowP ReselectionThreshold,

 threshServingLowQ ReselectionThresholdQ OPTIONAL, -- Need R

 cellReselectionPriority CellReselectionPriority,

 cellReselectionSubPriority CellReselectionSubPriority OPTIONAL, -- Need R

 ...

 },

 intraFreqCellReselectionInfo SEQUENCE {

 q-RxLevMin Q-RxLevMin,

 q-RxLevMinSUL Q-RxLevMin OPTIONAL, -- Need R

 q-QualMin Q-QualMin OPTIONAL, -- Need S

 s-IntraSearchP ReselectionThreshold,

 s-IntraSearchQ ReselectionThresholdQ OPTIONAL, -- Need S

 t-ReselectionNR T-Reselection,

 frequencyBandList MultiFrequencyBandListNR-SIB OPTIONAL, -- Need S

 frequencyBandListSUL MultiFrequencyBandListNR-SIB OPTIONAL, -- Need R

 p-Max P-Max OPTIONAL, -- Need S

 smtc SSB-MTC OPTIONAL, -- Need S

 ss-RSSI-Measurement SS-RSSI-Measurement OPTIONAL, -- Need R

 ssb-ToMeasure SSB-ToMeasure OPTIONAL, -- Need S

 deriveSSB-IndexFromCell BOOLEAN,

 ...,

 [[

 t-ReselectionNR-SF SpeedStateScaleFactors OPTIONAL -- Need S

 ]],

 [[

 smtc2-LP-r16 SSB-MTC2-LP-r16 OPTIONAL, -- Need R

 ssb-PositionQCL-Common-r16 SSB-PositionQCL-Relation-r16 OPTIONAL -- Cond SharedSpectrum

 ]]

 },

 ...,

 [[

 relaxedMeasurement-r16 SEQUENCE {

 lowMobilityEvaluation-r16 SEQUENCE {

 s-SearchDeltaP-r16 ENUMERATED {

 dB3, dB6, dB9, dB12, dB15,

 spare3, spare2, spare1},

 t-SearchDeltaP-r16 ENUMERATED {

 s5, s10, s20, s30, s60, s120, s180,

 s240, s300, spare7, spare6, spare5,

 spare4, spare3, spare2, spare1}

 } OPTIONAL, -- Need R

 cellEdgeEvaluation-r16 SEQUENCE {

 s-SearchThresholdP-r16 ReselectionThreshold,

 s-SearchThresholdQ-r16 ReselectionThresholdQ OPTIONAL -- Need R

 } OPTIONAL, -- Need R

 combineRelaxedMeasCondition-r16 ENUMERATED {true} OPTIONAL, -- Need R

 highPriorityMeasRelax-r16 ENUMERATED {true} OPTIONAL -- Need R

 } OPTIONAL -- Need R

 ]]

}

RangeToBestCell ::= Q-OffsetRange

-- TAG-SIB2-STOP

-- ASN1STOP

| *SIB2* field descriptions |
| --- |
| ***absThreshSS-BlocksConsolidation***Threshold for consolidation of L1 measurements per RS index. If the field is absent, the UE uses the measurement quantity as specified in TS 38.304 [20]. |
| ***cellEdgeEvaluation***Indicates the criteria for a UE to detect that it is not at cell edge, in order to relax measurement requirements for cell reselection (see TS 38.304 [20], clause 5.2.4.9.2). |
| ***cellReselectionInfoCommon***Cell re-selection information common for intra-frequency, inter-frequency and/ or inter-RAT cell re-selection. |
| ***cellReselectionServingFreqInfo***Information common for non-intra-frequency cell re-selection i.e. cell re-selection to inter-frequency and inter-RAT cells. |
| ***combineRelaxedMeasCondition***When both *lowMobilityEvalutation* and *cellEdgeEvalutation* criteria are present in SIB2, this parameter configures the UE to fulfil both criteria in order to relax measurement requirements for cell reselection. If the field is absent, the UE is allowed to relax measurement requirements for cell reselection when either or both of the criteria are met. (See TS 38.304 [20], clause 5.2.4.9.0) |
| ***deriveSSB-IndexFromCell***This field indicates whether the UE can utilize serving cell timing to derive the index of SS block transmitted by neighbour cell. If this field is set to *true*, the UE assumes SFN and frame boundary alignment across cells on the serving frequency as specified in TS 38.133 [14]. |
| ***frequencyBandList***Indicates the list of frequency bands for which the NR cell reselection parameters apply. The UE behaviour in case the field is absent is described in clause 5.2.2.4.3. |
| ***highPriorityMeasRelax***Indicates whether measurements can be relaxed on high priority frequencies. If the field is absent, the UE shall not relax measurements on high priority frequencies beyond "Thigher\_priority\_search" unless both low mobility and not at cell edge criteria are fulfilled (see TS 38.133 [14], clauses 4.2.2.7, 4.2.2.10 and 4.2.2.11). |
| ***intraFreqCellReselectionInfo***Cell re-selection information common for intra-frequency cells. |
| ***lowMobilityEvaluation***Indicates the criteria for a UE to detect low mobility, in order to relax measurement requirements for cell reselection (see TS 38.304 [20], clause 5.2.4.9.1). |
| ***nrofSS-BlocksToAverage***Number of SS blocks to average for cell measurement derivation. If the field is absent the UE uses the measurement quantity as specified in TS 38.304 [20]. |
| ***p-Max***Value in dBm applicable for the intra-frequency neighbouring NR cells. If absent the UE applies the maximum power according to TS 38.101-1 [15] in case of an FR1 cell or TS 38.101-2 [39] in case of an FR2 cell. In this release of the specification, if *p-Max* is present on a carrier frequency in FR2, the UE shall ignore the field and applies the maximum power according to TS 38.101-2 [39]. This field is ignored by IAB-MT. The IAB-MT applies output power and emissions requirements, as specified in TS 38.174 [63]. |
| ***q-Hyst***Parameter "*Qhyst*" in TS 38.304 [20], Value in dB. Value *dB1* corresponds to 1 dB, *dB2* corresponds to 2 dB and so on. |
| ***q-HystSF***Parameter "Speed dependent ScalingFactor for Qhyst" in TS 38.304 [20]. The *sf-Medium* and *sf-High* concern the additional hysteresis to be applied, in Medium and High Mobility state respectively, to Qhyst as defined in TS 38.304 [20]. In dB. Value *dB-6* corresponds to -6dB, *dB-4* corresponds to -4dB and so on. |
| ***q-QualMin***Parameter "Qqualmin" in TS 38.304 [20], applicable for intra-frequency neighbour cells. If the field is absent, the UE applies the (default) value of negative infinity for Qqualmin.  |
| ***q-RxLevMin***Parameter "Qrxlevmin" in TS 38.304 [20], applicable for intra-frequency neighbour cells. |
| ***q-RxLevMinSUL***Parameter "Qrxlevmin" in TS 38.304 [20], applicable for intra-frequency neighbour cells. |
| ***rangeToBestCell***Parameter "rangeToBestCell" in TS 38.304 [20]. The network configures only non-negative (in dB) values. |
| ***relaxedMeasurement***Configuration to allow relaxation of RRM measurement requirements for cell reselection (see TS 38.304 [20], clause 5.2.4.9). |
| ***s-IntraSearchP***Parameter "SIntraSearchP" in TS 38.304 [20]. |
| ***s-IntraSearchQ***Parameter "SIntraSearchQ" in TS 38.304 [20]. If the field is absent, the UE applies the (default) value of 0 dB for SIntraSearchQ. |
| ***s-NonIntraSearchP***Parameter "SnonIntraSearchP" in TS 38.304 [20]. If this field is absent, the UE applies the (default) value of infinity for SnonIntraSearchP. |
| ***s-NonIntraSearchQ***Parameter "SnonIntraSearchQ" in TS 38.304 [20]. If the field is absent, the UE applies the (default) value of 0 dB for SnonIntraSearchQ. |
| ***s-SearchDeltaP***Parameter "SSearchDeltaP" in TS 38.304 [20]. Value dB3 corresponds to 3 dB, dB6 corresponds to 6 dB and so on. |
| ***s-SearchThresholdP***Parameter "SSearchThresholdP" in TS 38.304 [20]. The network configures *s-SearchThresholdP* to be less than or equal to *s-IntraSearchP* and *s-NonIntraSearchP*. |
| ***s-SearchThresholdQ***Parameter "SSearchThresholdQ" in TS 38.304 [20]. The network configures *s-SearchThresholdQ* to be less than or equal to *s-IntraSearchQ* and *s-NonIntraSearchQ*. |
| ***smtc***Measurement timing configuration for intra-frequency measurement. If this field is absent, the UE assumes that SSB periodicity is 5 ms for the intra-frequnecy cells. |
| ***smtc2-LP***Measurement timing configuration for intra-frequency neighbour cells with a Long Periodicity (LP) indicated by periodicity in *smtc2-LP*. The timing offset and duration are equal to the offset and duration indicated in *smtc* in *intraFreqCellReselectionInfo*. The periodicity in *smtc2-LP* can only be set to a value strictly larger than the periodicity in *smtc* in *intraFreqCellReselectionInfo* (e.g. if *smtc* indicates sf20 the Long Periodicity can only be set to sf40, sf80 or sf160, if *smtc* indicates sf160, *smtc2-LP* cannot be configured). The *pci-List*, if present, includes the physical cell identities of the intra-frequency neighbour cells with Long Periodicity. If *smtc2-LP* is absent, the UE assumes that there are no intra-frequency neighbour cells with a Long Periodicity. |
| ***ssb-PositionQCL-Common***Indicates the QCL relation between SS/PBCH blocks for intra-frequency neighbor cells as specified in TS 38.213 [13], clause 4.1. |
| ***ssb-ToMeasure***The set of SS blocks to be measured within the SMTC measurement duration (see TS 38.215 [9]). When the field is absent the UE measures on all SS-blocks. |
| ***t-ReselectionNR***Parameter "TreselectionNR" in TS 38.304 [20]. |
| ***t-ReselectionNR-SF***Parameter "Speed dependent ScalingFactor for TreselectionNR" in TS 38.304 [20]. If the field is absent, the UE behaviour is specified in TS 38.304 [20]. |
| ***threshServingLowP***Parameter "ThreshServing, LowP" in TS 38.304 [20]. |
| ***threshServingLowQ***Parameter "ThreshServing, LowQ" in TS 38.304 [20]. |
| ***t-SearchDeltaP***Parameter "TSearchDeltaP" in TS 38.304 [20]. Value in seconds. Value *s5* means 5 seconds, value *s10* means 10 seconds and so on. |

|  |  |
| --- | --- |
| Conditional Presence | Explanation |
| *SharedSpectrum* | This field is mandatory present if this intra-frequency operates with shared spectrum channel access. Otherwise, it is absent, Need R. |

### 6.3.2 Radio resource control information elements

<skipped>

#### – *PUSCH-ServingCellConfig*

The IE *PUSCH-ServingCellConfig* is used to configure UE specific PUSCH parameters that are common across the UE's BWPs of one serving cell.

*PUSCH-ServingCellConfig* information element

-- ASN1START

-- TAG-PUSCH-SERVINGCELLCONFIG-START

PUSCH-ServingCellConfig ::= SEQUENCE {

 codeBlockGroupTransmission SetupRelease { PUSCH-CodeBlockGroupTransmission } OPTIONAL, -- Need M

 rateMatching ENUMERATED {limitedBufferRM} OPTIONAL, -- Need S

 xOverhead ENUMERATED {xoh6, xoh12, xoh18} OPTIONAL, -- Need S

 ...,

 [[

 maxMIMO-Layers INTEGER (1..4) OPTIONAL, -- Need M

 processingType2Enabled BOOLEAN OPTIONAL -- Need M

 ]],

 [[

 maxMIMO-LayersDCI-0-2-r16 SetupRelease { MaxMIMO-LayersDCI-0-2-r16} OPTIONAL -- Need M

 ]]

}

PUSCH-CodeBlockGroupTransmission ::= SEQUENCE {

 maxCodeBlockGroupsPerTransportBlock ENUMERATED {n2, n4, n6, n8},

 ...

}

MaxMIMO-LayersDCI-0-2-r16 ::= INTEGER (1..4)

-- TAG-PUSCH-SERVINGCELLCONFIG-STOP

-- ASN1STOP

|  |
| --- |
| *PUSCH-CodeBlockGroupTransmission* field descriptions |
| ***maxCodeBlockGroupsPerTransportBlock***Maximum number of code-block-groups (CBGs) per TB (see TS 38.213 [13], clause 9.1). |

|  |
| --- |
| *PUSCH-ServingCellConfig* field descriptions |
| ***codeBlockGroupTransmission***Enables and configures code-block-group (CBG) based transmission (see TS 38.214 [19], clause 6.1.5). |
| ***maxMIMO-Layers***Indicates the maximum MIMO layer to be used for PUSCH in all BWPs of the normal UL of this serving cell (see TS 38.212 [17], clause 5.4.2.1). If present, the network sets *maxRank* to the same value. For SUL, the maximum number of MIMO layers is always 1, and network does not configure this field. The field *maxMIMO-Layers* refers to DCI format 0\_1. |
| ***processingType2Enabled***Enables configuration of advanced processing time capability 2 for PUSCH (see 38.214 [19], clause 6.4). |
| ***rateMatching***Enables LBRM (Limited buffer rate-matching). When the field is absent the UE applies FBRM (Full buffer rate-matchingLBRM) (see TS 38.212 [17], clause 5.4.2). |
| ***xOverhead***If the field is absent, the UE applies the value 0 (see TS 38.214 [19], clause 6.1.4.2). |
| ***maxMIMO-LayersDCI-0-2***Indicates the maximum MIMO layer to be used for PUSCH for DCI format 0\_2 in all BWPs of the normal UL of this serving cell (see TS 38.212 [17], clause 5.4.2.1). If present, the network sets *maxRankDCI-0-2* to the same value. For SUL, the maximum number of MIMO layers is always 1, and network does not configure this field. |

# B.1 Protection of RRC messages

The following list provides information which messages can be sent (unprotected) prior to AS security activation and which messages can be sent unprotected after AS security activation. Those messages indicated "-" in "P" column should never be sent unprotected by gNB or UE. Further requirements are defined in the procedural text.

P…Messages that can be sent (unprotected) prior to AS security activation

A – I…Messages that can be sent without integrity protection after AS security activation

A – C…Messages that can be sent unciphered after AS security activation

NA… Message can never be sent after AS security activation

| Message | P | A-I | A-C | Comment |
| --- | --- | --- | --- | --- |
| *CounterCheck* | - | - | - |  |
| *CounterCheckResponse* | - | - | - |  |
| *DedicatedSIBRequest* | + | - | - |  |
| *DLDedicatedMessageSegment* | NOTE 1 |
| *DLInformationTransfer* | + | - | - |  |
| *DLInformationTransferMRDC* | - | - | - |  |
| *FailureInformation* | - | - | - |  |
| *IABOtherInformation* | - | - | - |  |
| *LocationMeasurementIndication* | - | - | - |  |
| *LoggedMeasurementConfiguration* | - | - | - |  |
| *MCGFailureInformation* | - | - | - |  |
| *MIB* | + | + | + |  |
| *MeasurementReport* | - | - | - | Measurement configuration may be sent prior to AS security activation. But: In order to protect privacy of UEs, *MeasurementReport* is only sent from the UE after successful AS security activation. |
| *MobilityFromNRCommand* | - | - | - |  |
| *Paging* | + | + | + |  |
| *RRCReconfiguration* | + | - | - | The message shall not be sent unprotected before AS security activation if it is used to perform handover or to establish SRB2 and DRBs. |
| *RRCReconfigurationComplete* | + | - | - | Unprotected, if sent as response to *RRCReconfiguration* which was sent before AS security activation. |
| *RRCReestablishment* | - | - | + | Integrity protection applied, but no ciphering. |
| *RRCReestablishmentComplete* | - | - | - |  |
| *RRCReestablishmentRequest* | - | - | + | This message is not protected by PDCP operation. However, a *shortMAC-I* is included. |
| *RRCReject* | + | + | + | Justification for A-I and A-C: the message can be sent in SRB0 in RRC\_INACTIVE state, after the AS security is activated. |
| *RRCRelease* | + | - | - | Justification for P: If the RRC connection only for signalling not requiring DRBs or ciphered messages, or the signalling connection has to be released prematurely, this message is sent as unprotected. *RRCRelease* message sent before AS security activation cannot include *deprioritisationReq, suspendConfig, redirectedCarrierInfo, cellReselectionPriorities* information fields. |
| *RRCResume* | - | - | - |  |
| *RRCResumeComplete* | - | - | - |  |
| *RRCResumeRequest* | - | - | + | This message is not protected by PDCP operation. However, a *resumeMAC-I* is included. |
| *RRCResumeRequest1* | - | - | + | This message is not protected by PDCP operation. However, a *resumeMAC-I* is included. |
| *RRCSetup* | + | + | + | Justification for A-I and A-C: the message can be sent in SRB0 in RRC\_INACTIVE or RRC\_CONNECTED states, after the AS security is activated. |
| *RRCSetupComplete* | + | NA | NA |  |
| *RRCSetupRequest* | + | NA | NA |  |
| *RRCSystemInfoRequest* | + | + | + | Justification for A-I and A-C: the message can be sent in SRB0 in RRC\_INACTIVE state, after the AS security is activated. |
| *SIB1* | + | + | + |  |
| *SCGFailureInformation* | - | - | - |  |
| *SCGFailureInformationEUTRA* | - | - | - |  |
| *SecurityModeCommand* | + | NA | NA | Integrity protection applied, but no ciphering (integrity verification done after the message received by RRC). |
| *SecurityModeComplete* | - | - | + | The message is sent after AS security activation. Integrity protection applied, but no ciphering. Ciphering is applied after completing the procedure. |
| *SecurityModeFailure* | + | NA | NA | Neither integrity protection nor ciphering applied. |
| *SidelinkUEInformationNR* | + | - | - | The message shall not be sent unprotected before AS security activation if *sl-CapabilityInformationSidelink* information field is included in the message. |
| *SystemInformation* | + | + | + |  |
| *UEAssistanceInformation* | - | - | - |  |
| *UECapabilityEnquiry* | + | - | - | The network should retrieve UE capabilities only after AS security activation. |
| *UECapabilityInformation* | + | - | - |  |
| *ULDedicatedMessageSegment* | + | - | - |  |
| *UEInformationRequest* | - | - | - |  |
| *UEInformationResponse* | - | - | - | In order to protect privacy of UEs, *UEInformationResponse* is only sent from the UE after successful security activation |
| *ULInformationTransfer* | + | - | - |  |
| *ULInformationTransferIRAT* | NOTE 2 |
| *ULInformationTransferMRDC* | - | - | - |  |
| NOTE 1: This message type carries segments of other RRC messages. The protection of an instance of this message is the same as for the message which this message is carrying.NOTE 2: This message type carries others RRC messages. The protection of an instance of this message is the same as for the message which this message is carrying. |