NOKIA

5G Mobility Training Series---2

5G Intra-Frequency mobility NSA option 3x

- Cplane R&D
- Jan.16, 2019

Content

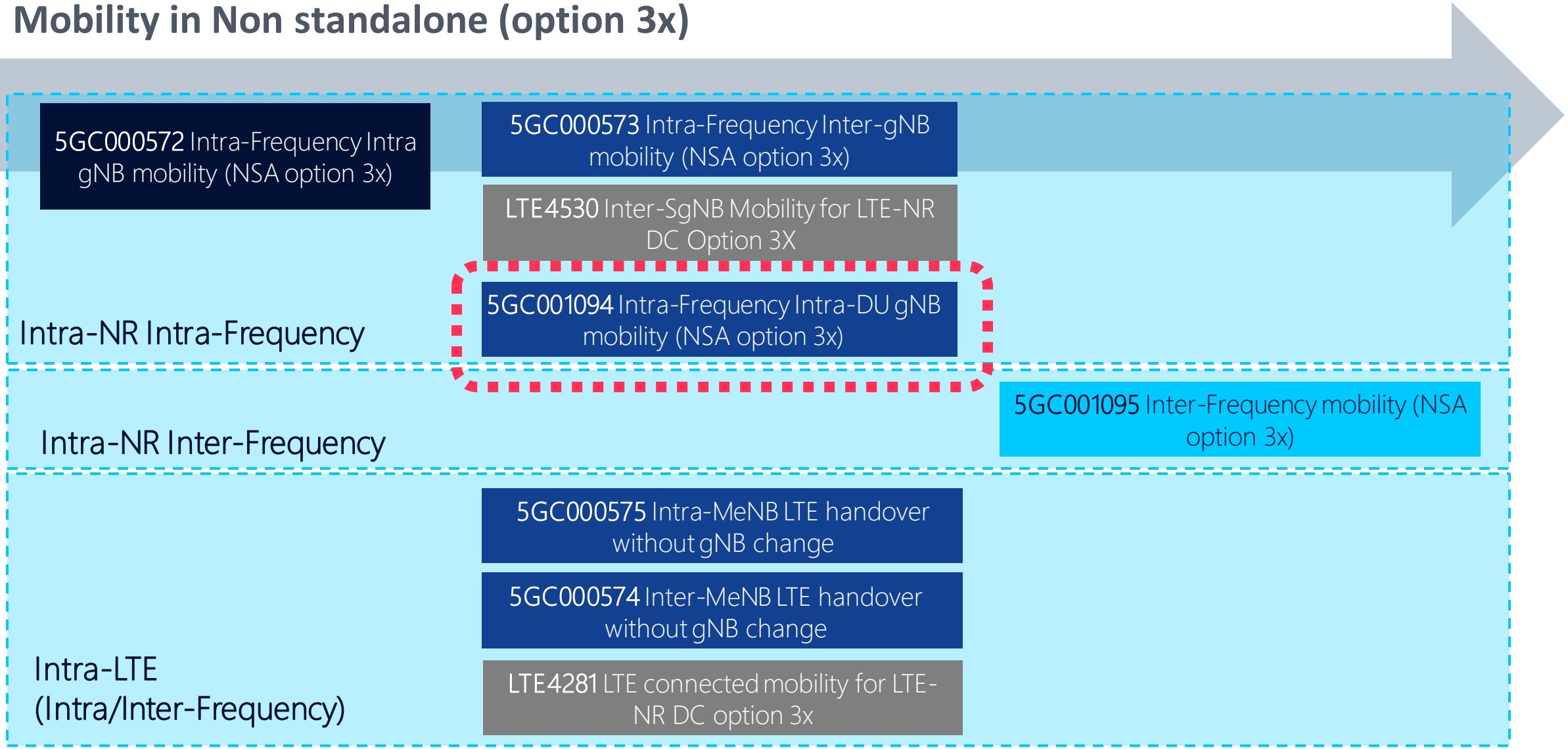
- NSA Mobility Introduction
- NSA Mobility Technical Details
- NSA Mobility Deploy Aspects

5G intra-frequency mobility(NSA)

Introduction

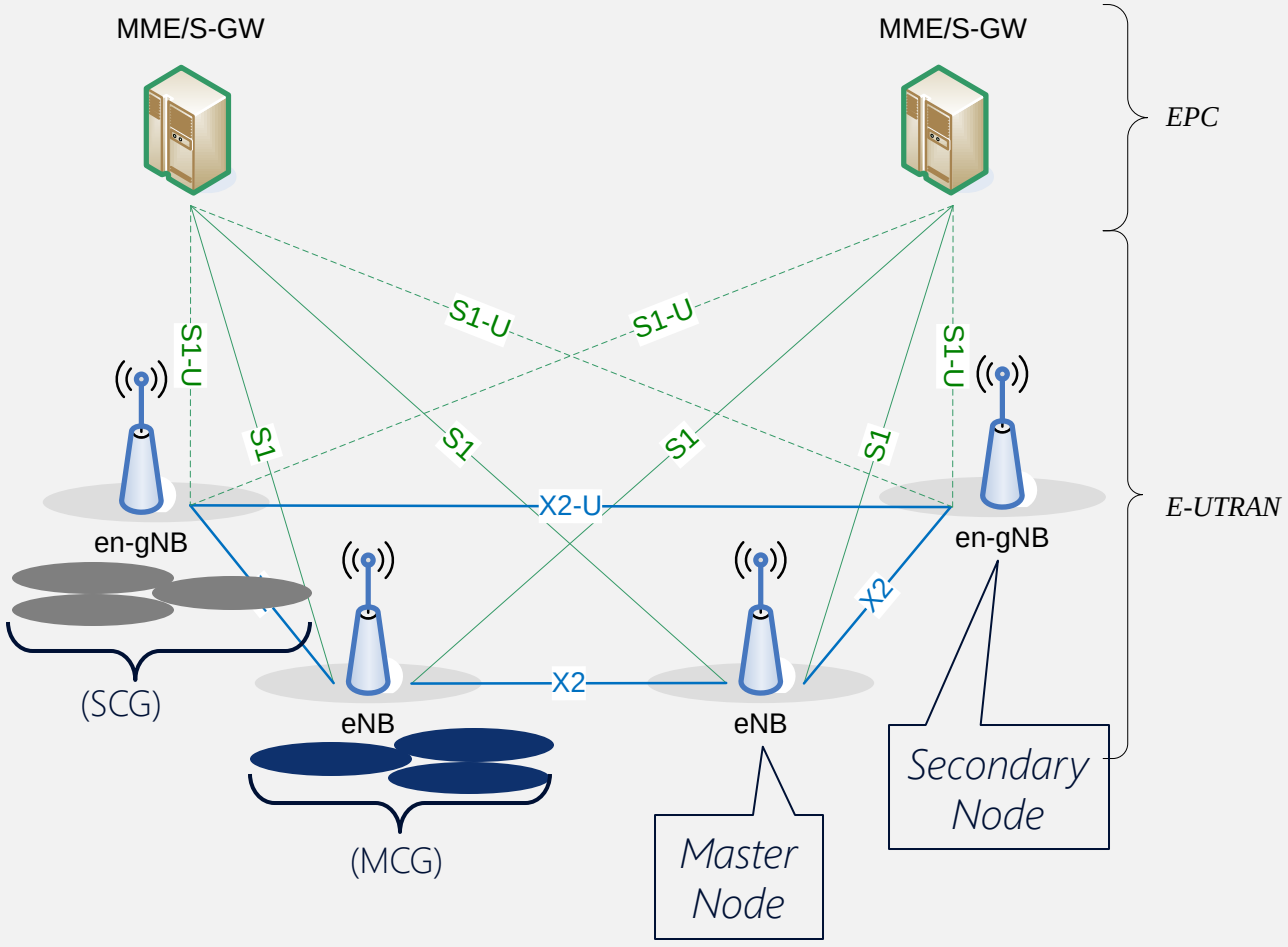
Introduction

Mobility in Non standalone (option 3x)



Introduction

EUTRAN – NR - DC architecture (EN-DC)



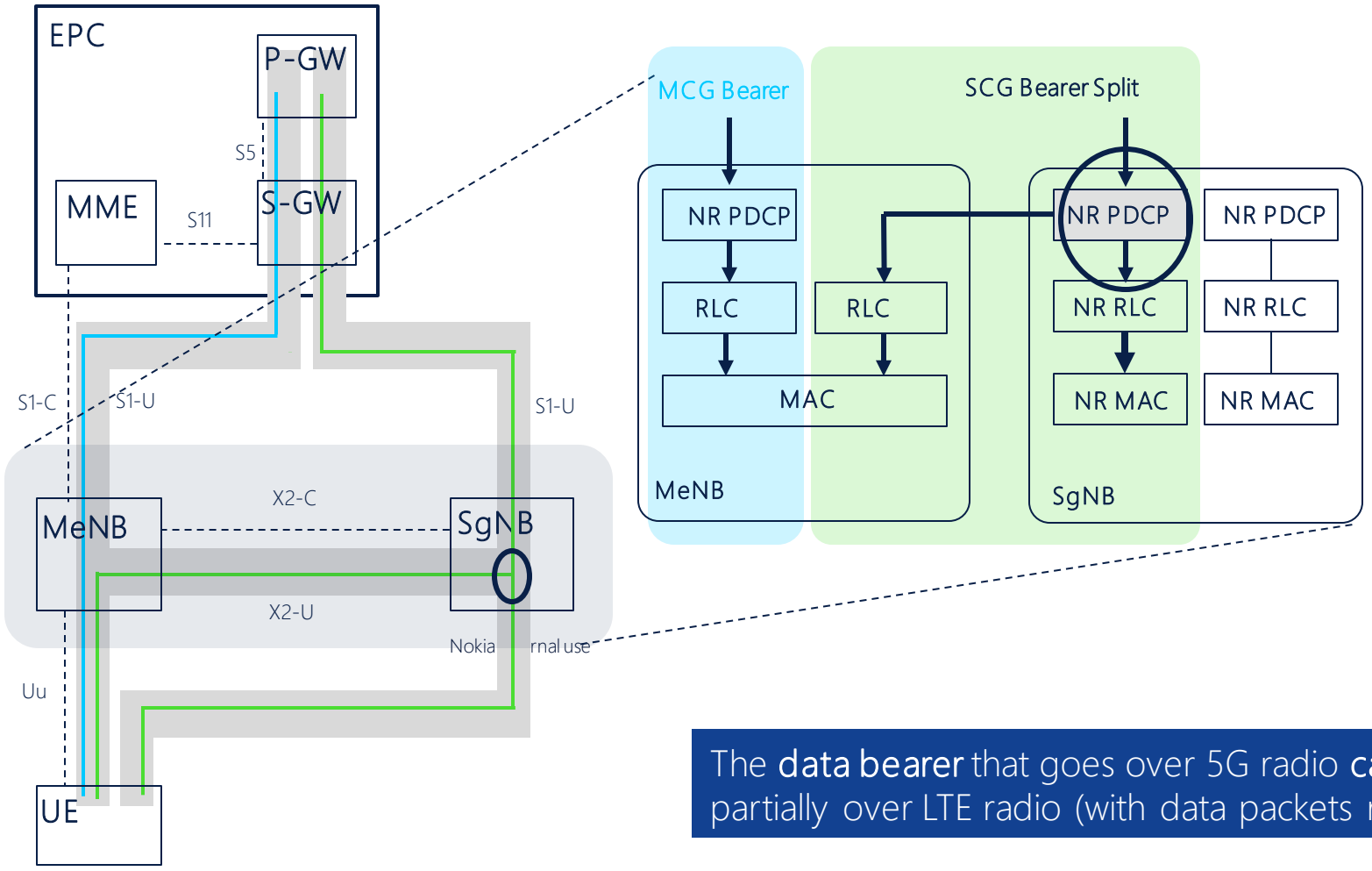
Reference: TS 37.340

- The mobility features in 5G NSA 3x work in ED-DC architecture. EN-DC is the Multi RAT Dual Connectivity and stands for EUTRA-NR Dual Connectivity.
- In EN-DC a UE is connected to one eNB that acts as Master Node (MN) and one 5G gNB that acts as Secondary Node (SN). The MN is known also as MeNB and SN as *en-gNB or SgNB.
- The eNB is connected to EPC via S1 and to the en-gNB via adjusted X2. The en-gNB might be also connected to the EPC via S1-U (no Control Plane connection to EPC) and other en-gNBs via the X2-U.
- MCG – a group of serving cells associated with the MN.
- SCG – a group of serving cells associated with the SN.

** NOTE: Letter en in en-gNB indicate that gNB operates EN-DC architecture*

Introduction

LTE - 5G Non-Standalone (NSA) Architecture Option 3x interworking



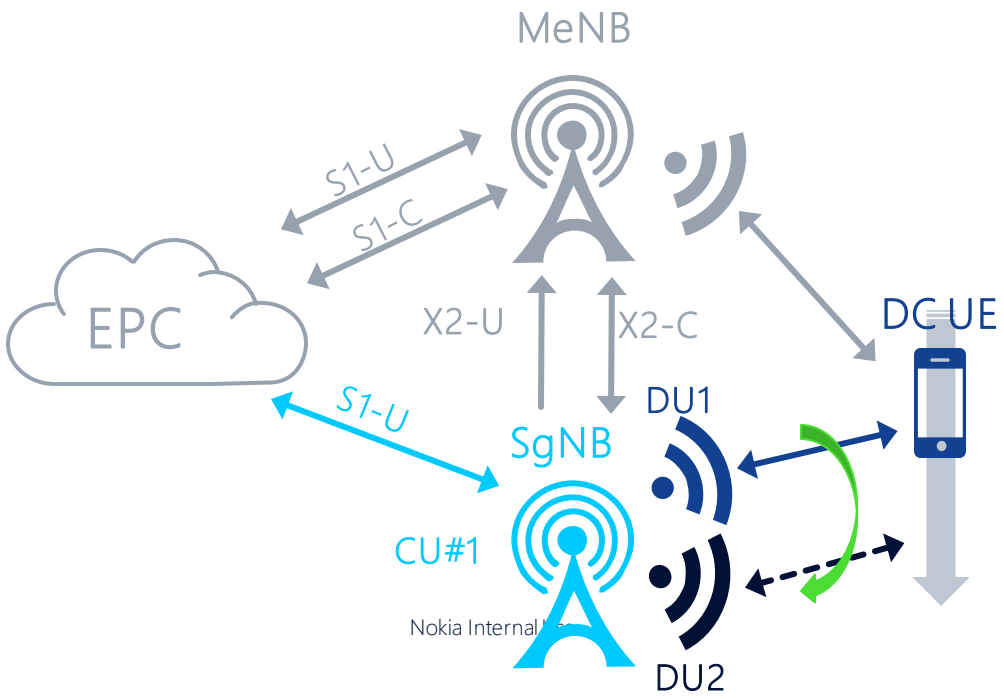
The Non-Standalone Architecture uses (reuses) the concept of split bearer.
The split bearer is a data bearer that is set up between two nodes (here: between LTE S-GW and 5G SgNB), but at the PDCP level the actual data can be split and sent over two different channels (here: 5G radio and LTE radio via X2 relay).
The PDCP layer at the UE will take care of reordering the received packets.

The **data bearer** that goes over 5G radio **can be split** and sent partially over 5G radio and partially over LTE radio (with data packets relayed over X2 connection).

5GC000572 Introduction

Feature overview

Intra-Frequency Intra gNB mobility (NSA option 3x)



This feature supports a network based intra-frequency change of the serving PSCell within a gNB (the same CU, between different DUs)

- SgNB triggers and manages PSCell change
- SgNB configures Intra-frequency measurements on UE by tunneling RRC signaling via MeNB over X2 AP messages
- A3/A5* event is triggered based on SS-RSRP/SS-RSRQ measurements (combined decision supported as well)
- The neighbor relations are operator configurable per PSCell

Note: As multiple sectors configuration per DU is not supported in 5G18A (**1 DU = 1 sector**), **only intra-CU inter-DU mobility** is allowed within this feature

*)- **Event A3**: "Neighbour becomes offset better than PSCell"
Event A5: "PSCell becomes worse than „threshold1" and neighbour becomes better than „threshold2"

Introduction

5GC000572 Intra-Frequency Intra gNB mobility (NSA option 3x)

NR Handover (HO) decision

- SgNB-CU receives **RRC NR measurement** report from MeNB via **X2 AP RRC Transfer message**

NR Handover Preparation

- SgNB-CU selects the target PSCell (based on A3 and/or A5 measurement report) and prepares target cell for PSCell change via **F1 UE Context Setup** procedure
- If CA feature is active in the SgNB, new Scells are assigned to the UE during PSCell change
  - The SCells are implicitly activated when SCells are configured.

NR Handover Execution

- SgNB-CU requests the source gNB-DU to stop scheduling UL/DL data via **F1 UE Context Modification**. Bearer is suspended.
- SgNB-CU initiates NR RRC Reconfiguration to UE over MeNB via **X2 SgNB Modification procedure** to execute the PSCell change
- When the UE accesses into the target PSCell, target SgNB-DU resumes DL/UL data transfer

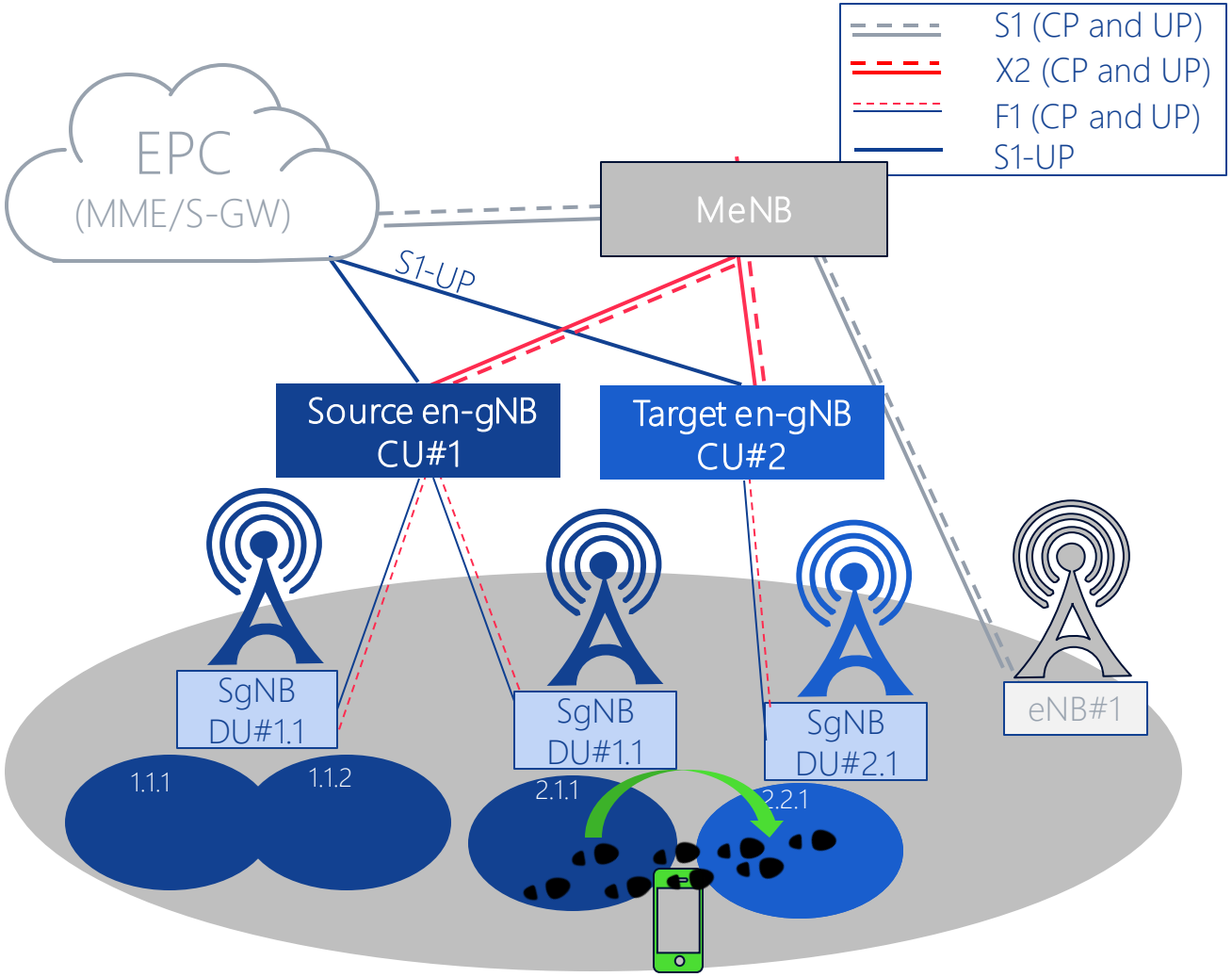
NR Handover Completion

- SgNB-CU releases the UE context at source gNB-DU via **F1 UE Context Release** procedure

RRC Signaling towards UE is done through MeNB over X2-C interface

Introduction

Feature overview (5GC000573)



In 5GC573 mobility occurs between *PSCells of different DU and different CU (inter DU & inter CU). The feature is also called inter en-gNB or inter SgNB HO

Main attributes of feature:

- During HO MeNB is not changed but is coordinating the HO procedure. Dual Connectivty is kept.
- The 5G cell change is triggered by SN.
- Feature is applicable for NSA calls with at least one established NR Bearer.
- Data forwarding from Source to Target is possible only for DL data. Check backup slide for more info.
- By default the NR call uses MCG signaling bearer (MCG SRB1), but it is possible to use direct SCG SRB3 (if 5GC00578 is available)
- Feature is activated on SgNB and MeNB

**NOTE: PSCell is the name of Primary cell for Secondary Node and SpCell is the primary cell of Master Node*

5GC573

Introduction

5GC000573 Handover procedure

NR Handover (HO) decision

- SgNB-CU receives **RRC NR measurement** report over MeNB or directly from UE (if 5GC00578 is available)

NR Handover Preparation

- The HO is initiated by Source SgNB-CU using X2AP Change Procedure
- MeNB prepares the target SgNB with parameters recevied during X2AP Change Procedure.
- Target cell applies Admission Controls and allocates radio resources according to configuration received from MeNB

NR Handover Execution

- Target SgNB requests to MeNB a PSCell change by sending RRC reconfiguration message (encapsulated in Addition Request Acknowledge msg)
- Once UE acknowledges the request MeNB informs about that the Target and the Source.
- UE performs Random Access procedure to Target cell.
- The status Transfer (HFN, SN).
- The data transfer (direct or indirect)

NR Handover Completion

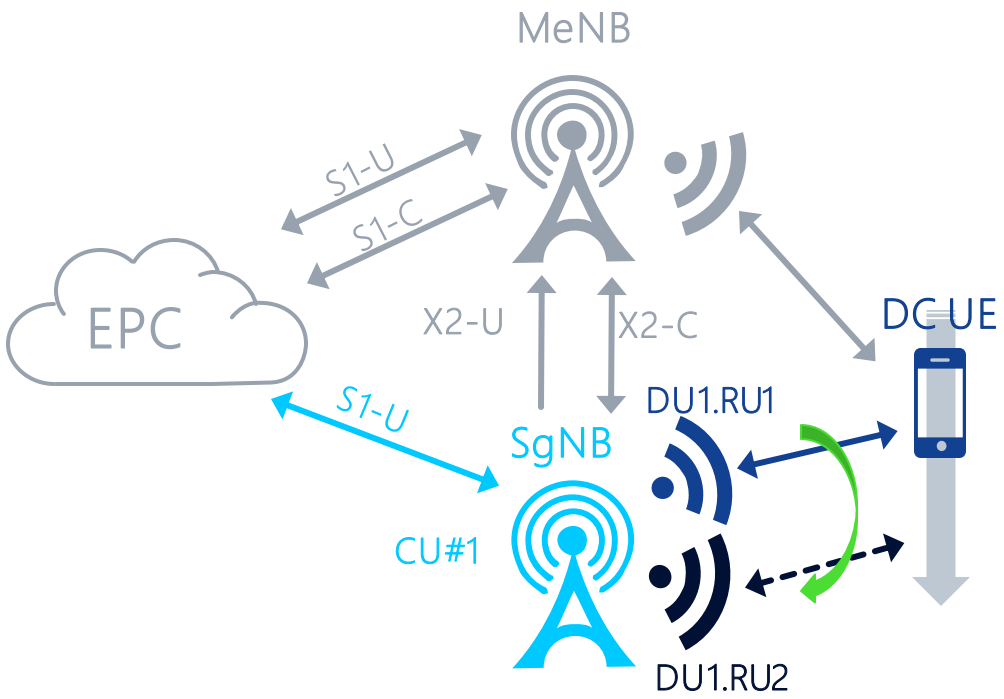
- UE and berear context release at Source SgNB

RRC Signaling towards UE is done through MeNB over X2-C interface or over direct SCG SRB3

5GC001904 Introduction

Feature overview

Intra-Frequency Intra gNB mobility (NSA option 3x)



This feature supports a network based **intra-frequency change** of the **serving** PSCell **within a gNB** (the same CU, the same DU, different RUs)

- SgNB triggers and manages PSCell change
- SgNB configures Intra-frequency measurements on UE by tunneling RRC signaling via MeNB over X2 AP messages
- A3/A5* event is triggered based on SS-RSRP/SS-RSRQ measurements (combined decision supported as well)
- The neighbor relations are operator configurable per PSCell

PSCell: Primary Cell in secondary Node (5G cell in EN-DC)

*)- **Event A3**: "Neighbour becomes offset better than PSCell"
Event A5: "PSCell becomes worse than „threshold1" and neighbour becomes better than „threshold2"

5GC001904 Introduction

Feature details (2/2)

- **Lossless handover** is supported in a similar way as 5GC000572.
- F1 signalling for intra-DU mobility relies on **UE Context Modification** procedure.
- The feature is activated by the same 5GNB level operator configurable parameter as 5GC000572

5GC001094 adds an automatic temporary **neighbor cell blacklisting** for intra-DU PSCell change in case of multiple handover preparation failure or when the handover preparation fails due to target cell overload.

- An automatic temporary neighbor cell blacklisting is applied for all UEs in the cell in case of a **multiple failed handover preparation due to timer expiry**. The number of expired handover preparations triggering the blacklisting and the duration of the blacklisting are operator configurable.
- When a target cell is temporary blacklisted, the target cell is **not considered as candidate** for handover by the source cell and Measurement reports are ignored.

MRBTS/NRBTS/actIntraFreqIntraGnbMobilityNSA

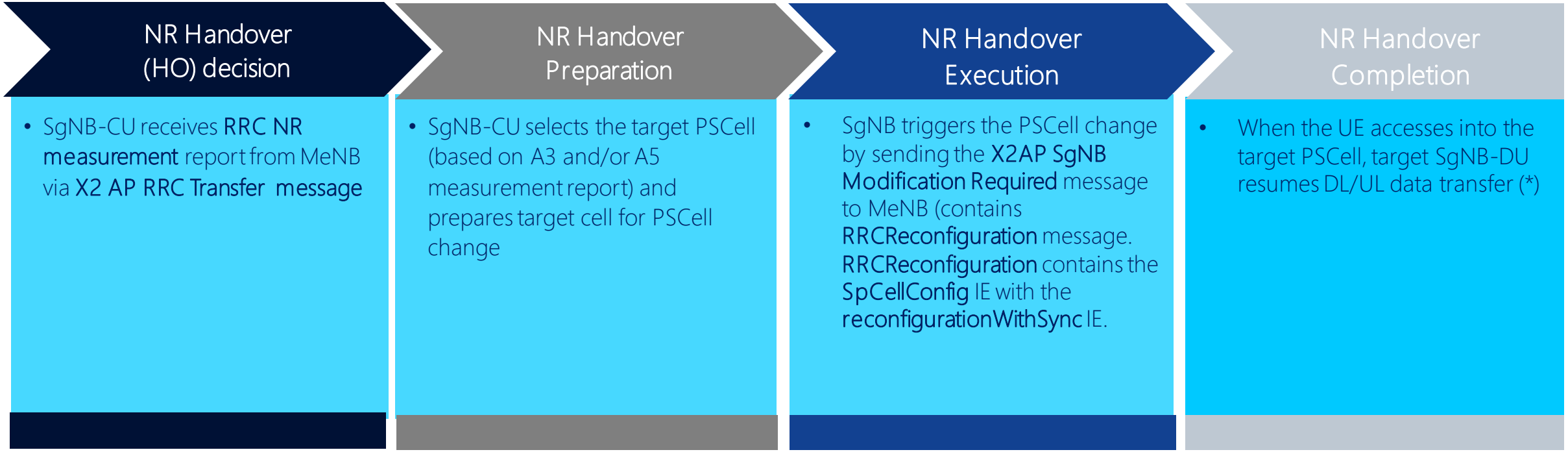
MRBTS/NRBTS/NRCELL/blockHoTimer

Note that the intra-gNB inter-DU mobility is delivered in three parts:

- 5G19: **5GC001094** Intra-Frequency Intra-DU en-gNB mobility (NSA option 3x)
- 5G19A: **5GC001829** Spillover from 5GC001094 (intra-DU PSCell change)
- 5G19B: **5GC002173** Second Spillover from 5GC001094 (intra-DU PSCell change)

Introduction

5GC001094 Intra-Frequency Intra-DU en-gNB mobility (NSA option 3x)



(*) After successful PSCell change on target cell SgNB re-transmits PDCP PDU, which are not delivered to UE and after that new PDCP PDUs are sent. After that SgNB releases the UE resources used in source cell

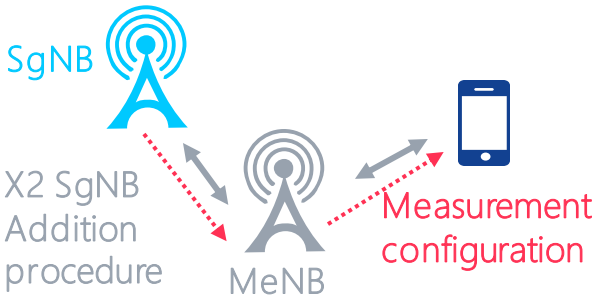
Introduction

Measurement configuration & reporting: **MCG SRB1**

The intra-frequency PSCell change is based on **downlink measurements** carried out by the UE

Measurement Configuration

- The **gNB provides NR measurement configurations** to the UE indirectly over MeNB (in EN-DC there is no default RRC over 5G radio interface)

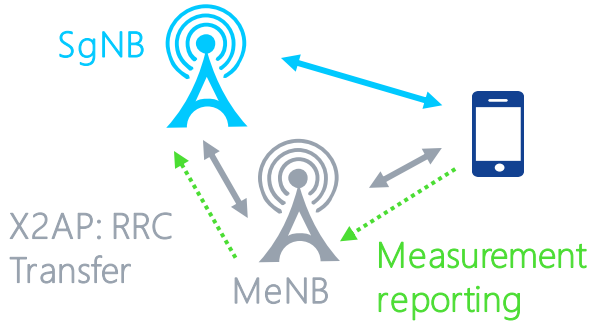


measurement profile:

- report events: A3, A5, A3&A5
- hysteresis, thresholds, time to trigger
- trigger quantity: SS-RSRP, SS-RSRQ

Measurement Report

- The **gNB receives** RRC NR measurement report from UE indirectly over MeNB via X2AP:RRC Transfer message



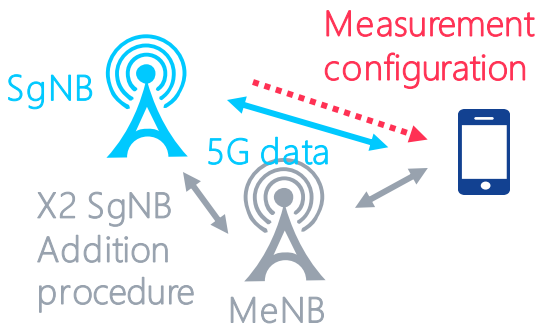
Introduction

Measurement configuration & reporting: **SCG SRB3**

The intra-frequency PSCell change is based on **downlink measurements** carried out by the UE

Measurement Configuration

- The **gNB provides NR measurement configurations** to the UE directly using SGC SRB3 – activated by 5GC000578 Direct RRC signalling

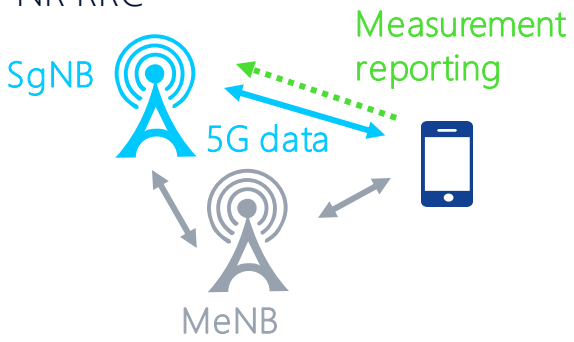


measurement profile:

- report events: A3, A5, A3&A5
- hysteresis, thresholds, time to trigger
- trigger quantity: SS-RSRP, SS-RSRQ

Measurement Report

- The **gNB receives** RRC NR measurement report from UE directly over NR RRC

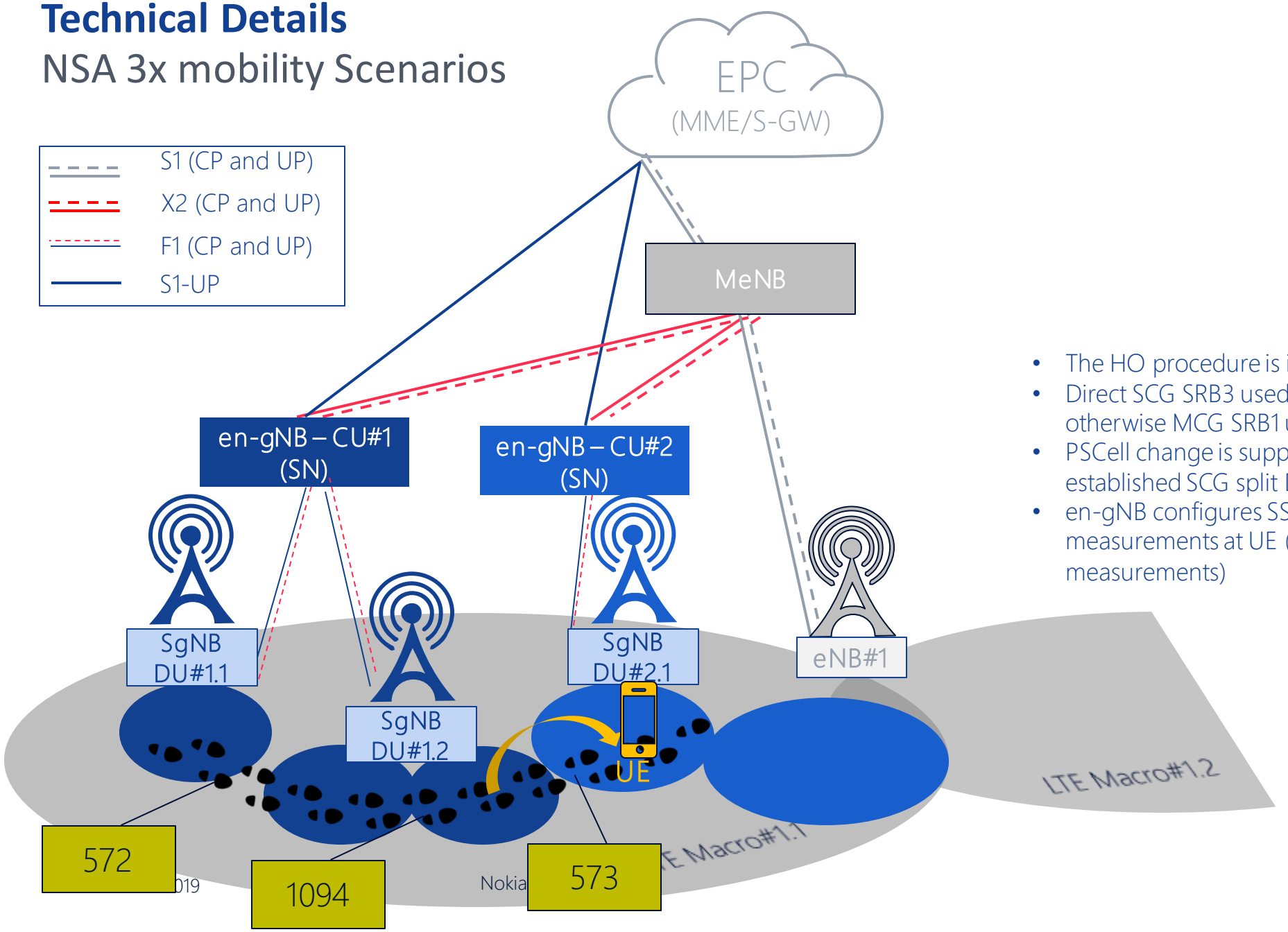


5G intra-frequency mobility(NSA)

Technical Details

Technical Details

NSA 3x mobility Scenarios



- The HO procedure is initiated by SN
- Direct SCG SRB3 used to receive NR measurement report otherwise MCG SRB1 used.
- PSCell change is supported for NSA calls with at least one established SCG split DRB
- en-gNB configures SSB based Intra-frequency measurements at UE (SS-RSRP / SS-RSRQ based A3 / A5 measurements)

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Technical Details

Measurement Configuration and Report

The intra-frequency PSCell change is based on downlink measurements carried out by the UE.

- The en-gNB provides the **NR measurement configurations to the UE** via **RRC signaling** supported through MCG SRB1 (tunneled through MeNB during **X2 SgNB Addition** Preparation procedure)
- The en-gNB receives RRC NR measurement report from MeNB via **X2AP RRC Transfer**.
- Or en-gNB received RRC NR Measurement report from UE via SRB3

The operator configurable parameters for the default measurement profile (applied for all UEs on PScell basis):

- report events: A3, A5, A3&A5 (*)
- trigger quantity: SS-RSRP, SS-RSRQ
- report quantity: all quantities (SS-RSRP, SS-RSRQ, SS-SINR)
- hysteresis, thresholds
- time to trigger.

The **reportOnLeave** is set as "**true**" to allow the UE to report when cell verifies the criteria, in which case UE sends a Measurement Report. When cell no longer verifies the criteria, UE sends an empty Measurement Report.

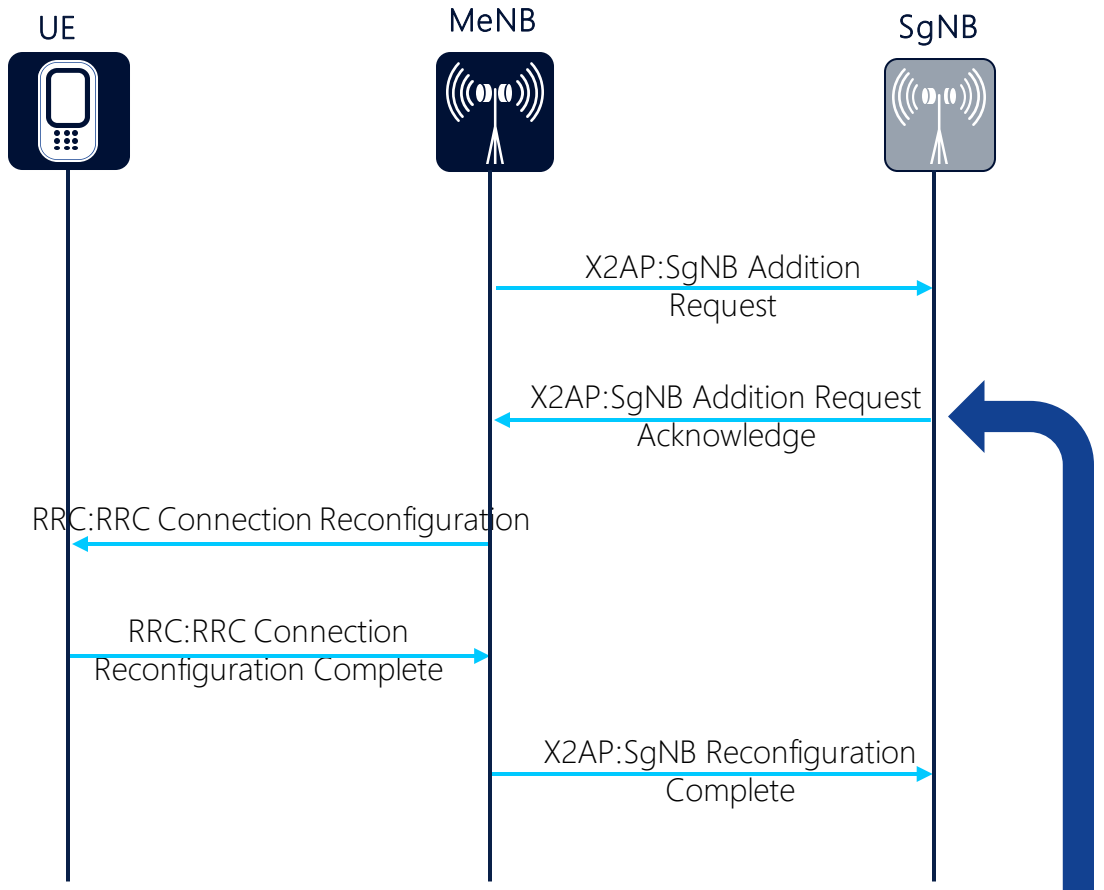
(*) Mobility events considered by 5GC000572/573/1094:
A3:"Neighbour becomes offset better than Pcell/PSCell"
A5:"Pcell/PSCell becomes worse than threshold1 and neighbour becomes better than threshold2"

Technical Details

Measurement configuration

When **Intra-Frequency Intra gNB mobility/Intra-Frequency inter-gNB mobility** is activated (*NRBTS/actIntraFreqIntraGnbMobilityNSA = true or/and actIntraFreqInterGnbMobilityNSA*) UE measurement can be configured either during SgNB Addition Preparation procedure (within the **X2AP: SgNB Addition Request Acknowledge** message) or PSCell change procedure (within **X2AP: SgNB Modification Required**)

- It is performed via **RRC: RRC Connection Reconfiguration** message containing a **measConfig IE**
- Measurement object is **serving carrier frequency**
- **A3 or/and A5 event** based measurement can be configured on UE (activated via *NRCELL/a3MeasEnabled*, *NRCELL/a5MeasEnabled* respectively)
- UE confirms to MeNB via **RRC: RRC Connection Reconfiguration Complete** that measurement configuration is applied – delivered to SgNB inside the **X2AP: SgNB Reconfiguration Complete message**



Technical Details

Measurement configuration – content of measConfig IE

NR RRC: RRCReconfiguration -> measConfig IE A3 and/or A5

IE/Group Name
measConfig
> measObjectToAddModList
> reportConfigToAddModList
> measIdToAddModList
> s-MeasureConfig
>> ssb-rsrp
> quantityConfig

IE/Group Name
MeasObjectToAddMod
>MeasObjectNR
>> ssbFrequency
>> referenceSignalConfig
>> nroSS-BlocksToAverage
>> absThreshSSBlocksConsolidation
>>> thresholdRSRP
>>> thresholdRSRQ
>> cellsToAddModList

Measurement configuration (measConfig IE) includes the following information elements:

- measObjectToAddModList defines list of measurement objects (MeasObjectToAddMod containing **MeasObjectNR**) to add and/or modify, including:
  - ssbFrequency – ARFCN value of measured SS/PCH block
  - referenceSignalConfig - RS configuration (see next slide), e.g:
    - periodicityAndOffset– Periodicity (*NRCELL/ssb-smtc1Periodicity*) and offset (*NRCELL/ssb-smtc1Offset*) of the measurement window in which to receive SS/PBCH blocks
    - duration – Duration (*NRCELL/ssb-smtc1Duration)* of the measurement window (in number of subframes) in which to receive SS/PBCH blocks

Technical Details

Measurement configuration – content of measConfig IE

NR RRC: RRCReconfiguration -> measConfig IE A3 and/or A5

IE/Group Name
measConfig
> measObjectToAddModList
> reportConfigToAddModList
> measIdToAddModList
> s-MeasureConfig
>> ssb-rsrp
> quantityConfig

IE/Group Name
MeasObjectToAddMod
>MeasObjectNR
>> ssbFrequency
>> referenceSignalConfig
>> nroSS-BlocksToAverage
>> absThreshSSBlocksConsolidation
>>> thresholdRSRP
>>> thresholdRSRQ
>> cellsToAddModList

- nroSS-BlocksToAverage – Number of measurement SS-Blocks to average (controled via *NRCELL:nroSsbToAverage*)
- absThreshSSBlocksConsolidation defines the absolute RSRP and RSRQ thresholds for the consolidation of measurement results per SS/PBCH block(s):
  - thresholdRSRP - setup via *NRCELL/absThreshSsbRsrpConsolidation*
  - thresholdRSRQ - setup via *NRCELL/absThreshSsbRsrqConsolidation*
- cellsToAddModlist – specifies a list of cells (up to 32 defined via CellsToAddMod IE) with at least one of its **cellIndividualOffset** (RSRP or RSRQ) different from 0dB

There is **cellIndividualOffset** IE which can be controlled by parameter, separatly defined for RSRP and RSRQ:

- For the source cell:
  - *NRCELL/cellIndividualSsbRsrpOffset*
  - *NRCELL/cellIndividualSsbRsrqOffset*
- For the neighbor cell:
  - *NRREL/cellIndividualSsbRsrpOffset*
  - *NRREL/cellIndividualSsbRsrqOffset*

Technical Details

Measurement configuration - content of measConfig IE

NR RRC: RRCReconfiguration -> measConfig IE A3 and/or A5

IE/Group Name
measConfig
> measObjectToAddModList
> reportConfigToAddModList
> measIdToAddModList
> s-MeasureConfig
>> ssb-rsrp
> quantityConfig

IE/Group Name
ReportConfigToAddMod
> reportConfigId
> reportConfig
>> reportConfigNR

- reportConfigToAddModList specifies list of measurement configurations (ReportConfigToAddMod) to add and/or modify, including:
  - reportConfigId– used to identify a measurement reporting configuration
  - reportConfig specifies criteria for triggering of an measurement reporting event (A3 and/or A5) - for NR reportConfigNR structure is defined

```
reportConfigNR
  reportType: eventTriggered (1)
    eventTriggered
      eventId: eventA3 (2)
        eventA3
          a3-Offset: rsrp (0)
          0... .... reportOnLeave: False
          hysteresis: 0dB (0)
          timeToTrigger: ms40 (1)
          ..0. .... useWhiteCellList: False
      rsType: ssb (0)
      reportInterval: ms640 (3)
      reportAmount: r4 (2)
      reportQuantityCell
        ...1 .... rsrp: True
        .... 1... rsrq: True
        .... .1.. sinr: True
      maxReportCells: 8
      reportQuantityRS-Indexes
        .1.. .... rsrp: True
        ..1. .... rsrq: True
        ...1 .... sinr: True
      maxNrofRS-IndexesToReport: 8
      .1.. .... includeBeamMeasurements: True
```

Technical Details

Measurement configuration - content of measConfig IE

NR RRC: RRCReconfiguration -> measConfig IE A3 and/or A5

IE/Group Name
measConfig
> measObjectToAddModList
> reportConfigToAddModList
> measIdToAddModList
> s-MeasureConfig
>> ssb-rsrp
> quantityConfig

IE/Group Name
MeasIdToAddMod
> measId
> measObjectId
> reportConfigId

- measIdToAddModList - for linking a report config to a measurement object
- s-MeasureConfig - Threshold for PSCell RSRP measurement controlling when the UE is required to perform measurements associated to neighbouring cells
  - ssb-rsrp – it corresponds to cell RSRP based on SS/PBCH block – configured via *NRCELL/smeasConfigSsbRsrp*

```
s-MeasureConfig: ssb-RSRP (0)
   ssb-RSRP: -61dBm <= SS-RSRP < -60dBm (96)
quantityConfig
   quantityConfigNR-List: 1 item
      Item 0
         QuantityConfigNR
            quantityConfigCell
               ssb-FilterConfig
               csi-RS-FilterConfig
            quantityConfigRS-Index
               ssb-FilterConfig
               csi-RS-FilterConfig
```


Technical Details

Measurement configuration – content of reportConfigNR IE

IE/Group Name	Setup
reportType	
>eventTriggered	Hardcoded as eventTriggered
>> eventId	
>>> eventA3	*NRCELL/a3MeasEnabled*
>>>> a3-Offset	
>>>>> rsrp	*NRCELL/a3OffsetSsbRsrp*
>>>>> rsrq	*NRCELL/a3OffsetSsbRsrq*
>>>> reportOnLeave	Hardcoded to TRUE
>>>> hysteresis	*NRCELL/a3HysteresisSsbRsrp* *NRCELL/a3HysteresisSsbRsrq*
>>>> timeToTrigger	*NRCELL/a3TimeToTriggerSsbRsrp* *NRCELL/a3TimeToTriggerSsbRsrq*
>>> eventA5	*NRCELL/a5MeasEnabled*
>>>> a5-Threshold1	
>>>>> rsrp	*NRCELL/a5Threshold1SsbRsrp*
>>>>> rsrq	*NRCELL/a5Threshold1SsbRsrq*
>>>> a5-Threshold2	
>>>>> rsrp	*NRCELL/a5Threshold2SsbRsrp*
>>>>> rsrq	*NRCELL/a5Threshold2SsbRsrq*

IE/Group Name	Setup
>>>> reportOnLeave	Hardcoded to TRUE
>>>> hysteresis	*NRCELL/a5HysteresisSsbRsrp* *NRCELL/a5HysteresisSsbRsrq*
>>>> timeToTrigger	*NRCELL/a5TimeToTriggerSsbRsrp* *NRCELL/a5TimeToTriggerSsbRsrq*
>> rsType	Hardcoded to ssb
>> reportInterval	Hardcoded to ms240
>> reportAmount	Hardcoded to r1
>> reportQuantityCell	
>>> rsrp	Hardcoded to TRUE
>>> rsrq	Hardcoded to TRUE
>>> sinr	Hardcoded to TRUE
>> maxReportCells	Hardcoded to 8
>> reportQuantityRsIndexes	
>>> rsrp	Hardcoded to TRUE
>>> rsrq	Hardcoded to TRUE
>>> sinr	Hardcoded to TRUE
>> maxNrofIndexesToReport	Hardcoded to 8
>> includeBeamMeasurements	Hardcoded to TRUE

Technical Details

Measurement configuration - content of measConfig IE

NR RRC: RRCReconfiguration -> measConfig IE A3 and/or A5

IE/Group Name
measConfig
> measObjectToAddModList
> reportConfigToAddModList
> measIdToAddModList
> s-MeasureConfig
>> ssb-rsrp
> quantityConfig

IE/Group Name
quantityConfigNR-list
> QuantityConfigNR
>> quantityConfigCell
>>> QuantityConfigRS
>>>> ssb-FilterConfig
>>>>> FilterConfig
>>>>>> FilterCoefficient

- qunatityConfig - specifies filter coefficient value for RS type SS/PBCH blocks and measurement quantities RSRP/RSQ. This value is defined within **FilterCoefficient** IE via:
  - *NRCELL/filterCoeffSsbRsrp* for RSRP
  - *NRCELL/filterCoeffSsbRsrq* for RSRQ

```
s-MeasureConfig: ssb-RSRP (0)
    ssb-RSRP: -61dBm <= SS-RSRP < -60dBm (96)
quantityConfig
  quantityConfigNR-List: 1 item
    Item 0
      QuantityConfigNR
        quantityConfigCell
            ssb-FilterConfig
            csi-RS-FilterConfig
        quantityConfigRS-Index
            ssb-FilterConfig
            csi-RS-FilterConfig
```

Technical Details

Possible measurement configuration options

- In 5G18A handovers between 5G cells are possible based on event A3 or event A5 radio conditions measured in RSRP/RSRQ domain

- Which measurement option is effectively in use depends not only on configured thresholds (RSRP/RSRQ based) but also on the setting of two parameters:
  - NRCELL:a3MeasEnabled = none (0), rsrp (1), rsrq (2), rsrpAndRsrq (3), rsrpCombined (4), rsrqCombined (5)
  - NRCELL:a5MeasEnabled = none (0), rsrp (1), rsrq (2), rsrpAndRsrq (3), rsrpCombined (4), rsrqCombined (5)

- In both cases possible values mean:

  - none (0) even the thresholds for RSRP and RSRQ are configured in SgNB database no measurement configuration is provided to the UE terminal

  - rsrp (1) even the thresholds for RSRP and RSRQ are configured in SgNB database, only RSRP based measurement configuration is provided to the UE terminal; HO preparation phase is triggered after receiving Measurement Report for this RSRP based event

  - rsrq (2) even the thresholds for RSRP and RSRQ are configured in SgNB database, only RSRQ based measurement configuration is provided to the UE terminal; HO preparation phase is triggered after receiving Measurement Report for this RSRQ based event

Technical Details

Possible measurement configuration options

```
EventTriggerConfig::=                    SEQUENCE {
    eventId                                  CHOICE {
        eventA1                                  SEQUENCE {
            a1-Threshold                             MeasTriggerQuantity,
            reportOnLeave                            BOOLEAN,
            hysteresis                               Hysteresis,
            timeToTrigger                            TimeToTrigger
        },
        eventA2                                  SEQUENCE {
            a2-Threshold                             MeasTriggerQuantity,
            reportOnLeave                            BOOLEAN,
            hysteresis                               Hysteresis,
            timeToTrigger                            TimeToTrigger
        },
        eventA3                                  SEQUENCE {
            a3-Offset                                MeasTriggerQuantityOffset,
            reportOnLeave                            BOOLEAN,
            hysteresis                               Hysteresis,
            timeToTrigger                            TimeToTrigger,
```

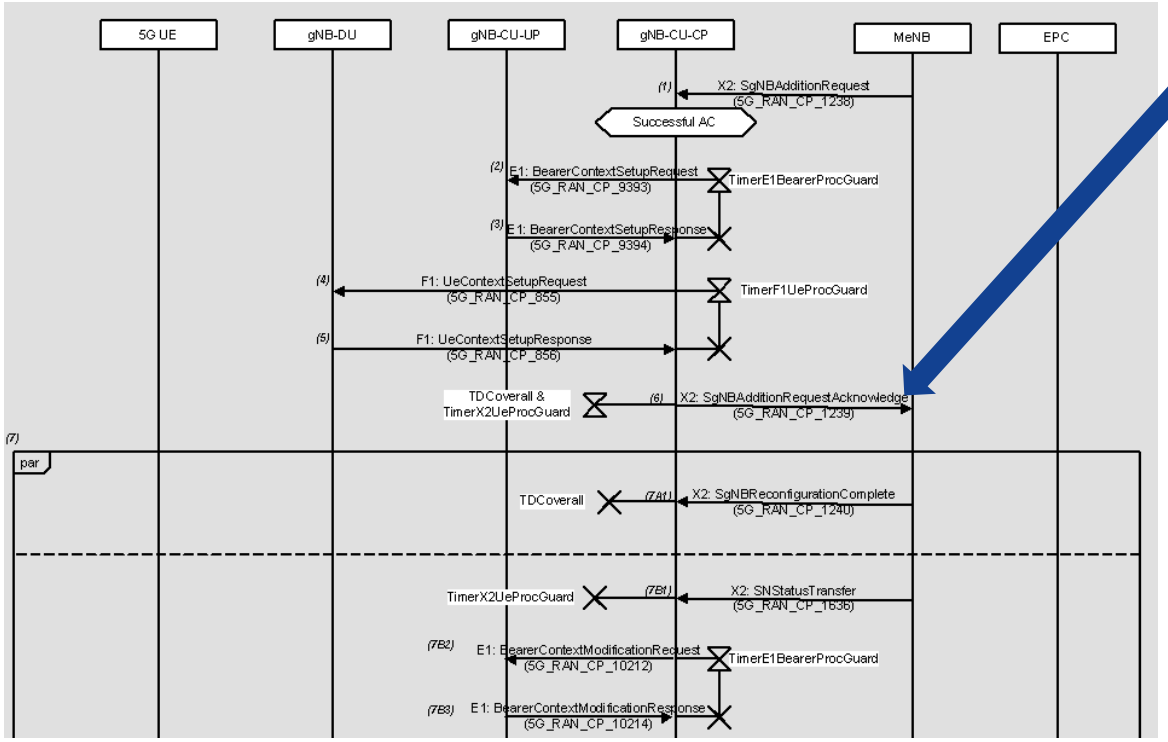
- **rsrpAndRsrq (3)** thresholds for **RSRP and RSRQ** are configured and both measurement configuration are provided to the UE terminal as separate measurements; HO preparation phase is triggered after receiving Measurement Report for this event **either RSRP or RSRQ based**

- **rsrpCombined (4)** even the thresholds for RSRP and RSRQ are configured **only RSRP based** measurement configuration is provided to the UE terminal; after detection by the UE terminal radio conditions for event A3/A5 in RSRP domain and reporting it by Measurement Report, the SgNB takes into account **also reported RSRQ levels** of serving and target cell; HO preparation phase may be triggered if also **reported RSRQ levels meet the radio conditions for event A3/A5** defined in SgNB database by **RSRQ related** thresholds.

- **rsrqCombined (5)** even the thresholds for RSRP and RSRQ are configured **only RSRQ based** measurement configuration is provided to the UE terminal; after detection by the UE terminal radio conditions for event A3/A5 in RSRQ domain and reporting it by Measurement Report the SgNB takes into account **also reported RSRP levels** of serving and target cell; HO preparation phase may be triggered if also **reported RSRP levels meet the radio conditions for event A3/A5** defined in SgNB database by **RSRP related** thresholds.

Technical Details

Measurement Configuration




```
SgNBtoMeNBContainer: 18440e18640d02e2078e519032fe30d061e6407c0204a83c...
  CG-Config
    criticalExtensions: c1 (0)
      c1: cg-Config (0)
        cg-Config
          scg-CellGroupConfig: 0c81a05c40f1ca32065fc61a0c3cc80f80409507884020ca...
            RRCReconfiguration
              rrc-TransactionIdentifier: 0
              criticalExtensions: rrcReconfiguration (0)
                rrcReconfiguration
                  secondaryCellGroup: 5c40f1ca32065fc61a0c3cc80f80409507884020cae85398...
                  measConfig
                    measObjectToAddModList: 1 item
                      Item 0
                        MeasObjectToAddMod
                    reportConfigToAddModList: 1 item
                      Item 0
                        ReportConfigToAddMod
                    measIdToAddModList: 1 item
                      Item 0
                        MeasIdToAddMod
                    s-MeasureConfig: ssb-RSRP (0)
                      ssb-RSRP: -61dBm <= SS-RSRP < -60dBm (96)
                    quantityConfig
                      quantityConfigNR-List: 1 item
                        Item 0
                          QuantityConfigNR
Item 0
  MeasObjectToAddMod
    measObjectId: 1
    measObject: measObjectNR (0)
      measObjectNR
        ssbFrequency: 643296
        ssbSubcarrierSpacing: kHz30 (1)
        smtc1
        referenceSignalConfig
        absThreshSS-BlocksConsolidation
        quantityConfigIndex: 1
        offsetMO
        freqBandIndicatorNR-v1530: 78
        measCycleSCell-v1530: sf160 (0)
reportConfigToAddModList: 1 item
  Item 0
    ReportConfigToAddMod
      reportConfigId: 1
      reportConfig: reportConfigNR (0)
        reportConfigNR
          reportType: eventTriggered (1)
            eventTriggered
              eventId: eventA3 (2)
                eventA3
                  a3-Offset: rsrp (0)
```

```
measIdToAddModList: 1 item
  Item 0
    MeasIdToAddMod
      measId: 1
      measObjectId: 1
      reportConfigId: 1
s-MeasureConfig: ssb-RSRP (0)
```

(*) Mobility events considered by 5GC000572/573/1094:
A3:"Neighbour becomes offset better than Pcell/PSCell"
A5:"Pcell/PSCell becomes worse than threshold1 and neighbour becom

Technical Details

Measurement Configuration Management--Context

5G-CP-UE shall mantain two classes of Measurement Configuration Context:

- **MeasurementUeContext**: shall be added into per UE Context
- **MeasurementProcedureContext**: shall bed added into per UE level procedure that need to generate/update measurement configurations to UE. This context can be created at procedure start and the context shall be delivered into MeasurementUeContext at the procedure completion.

Both of these two Measurement Configuation Contexts shall include the informations below:

- **Measurement State**: current Measurement State that the UE shall be on. [5G_RAN_CP_34547]
- **Measurement Report Info List**: a storage based on the UE current measurement configuations, a list of the Measurement Report Info on each measId. [5G_RAN_CP_34549]
- **Var Meas Config**: [5G_RAN_CP_34550]
- **Measurement Profiles**: [5G_RAN_CP_34845]. Will available after first measurement configuration procedure, and may update at subsequent measurement configuation procedure (e.g. when serving cell changed).

In the **MeasurementProcedureContext**, it shall include below additional information:

- **measConfig**: the RRC IEs that need send to UE during this procedure, the context may be different with **Var Meas Config**. And this context do not need to be delivered to MeasurementUeContext.

Technical Details

Measurement Configuration Management—Measurement Purpose

"Measurement Purpose" is used to define the class of UE measured target carrier frequencies, and the type of the UE will report on this target carrier frequency.

Measurement purpose	Meas Object	Report Config	Description

IntraFreqMeas	5G NR Intra-frequency	A3/A4/A5	On serving cell carrier frequency and neighboring cell carrier frequency, for 5G NR intra frequency measurements
			[5GC000572][5GC000573]
			{
			Report Config A3 and A5 is introduced on this purpose
			}

LeaveAlarm	5G NR Intra-frequency	A1	On serving cell carrier frequency, when measuring that the UE's radio condition is becoming better than the "Alarm" state
			[5GC001095]
			{
			Report Config A1 is introduced on this purpose
			}

EnterAlarm	5G NR Intra-frequency	A2	On serving cell carrier frequency, when measuring that the UE's radio condition is becoming worse into an "Alarm" state [5GC001095]

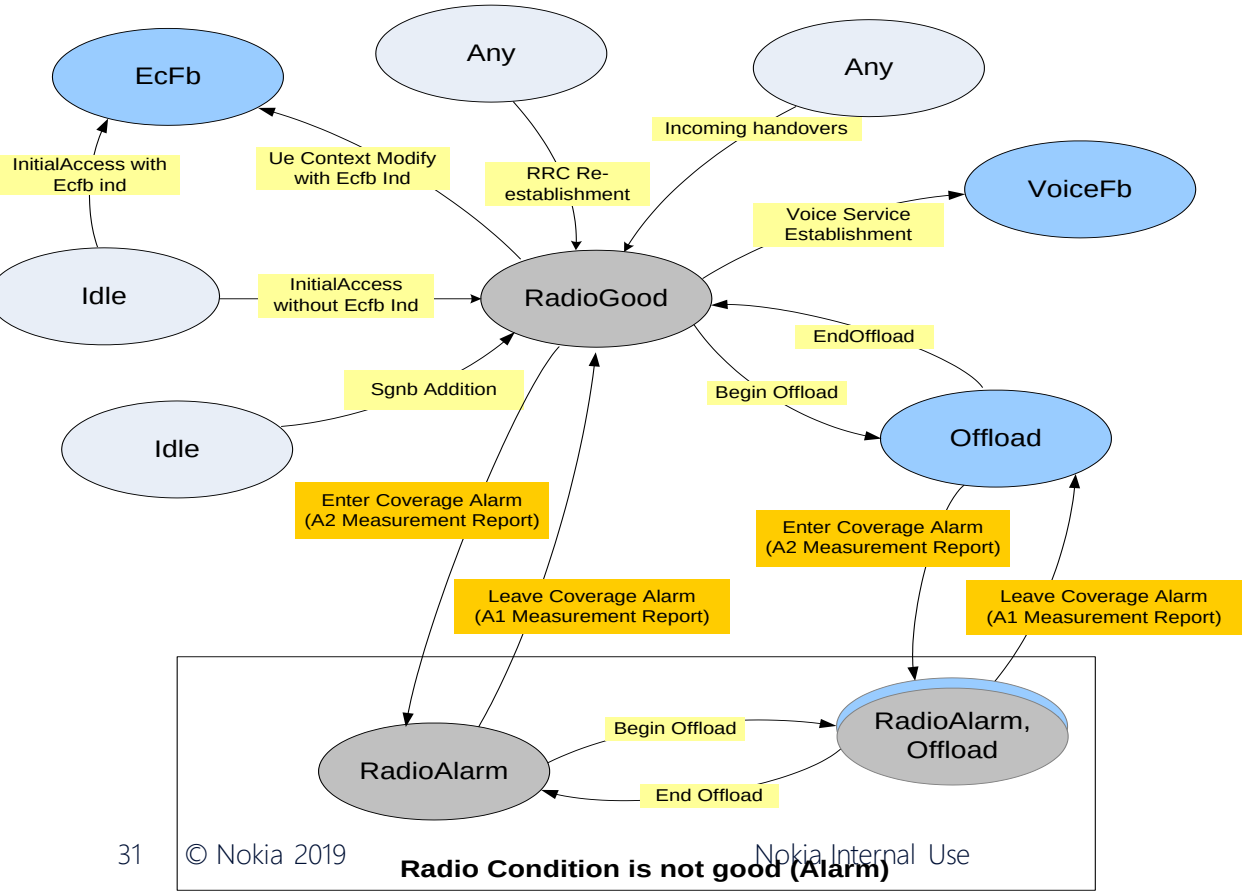
InterFreqMeas	5G NR Inter-frequency	A3/A4/A5	On neighboring cell carrier frequency, for 5G NR inter-frequency measurements
			[5GC001095]
			{
			Report Config A3 and A5 is introduced on this purpose
			}

EutranMeas	EUTRA	B1/B2	On EUTRA carrier frequency, for Inter-RAT of LTE measurements

Technical Details

Measurement Configuration Management—Measurement State

The “RRC Measurement State” is to define the UE is just under which Radio Condition (Radio Conddition States), and to define the UE is just during 3GPP mobility related procedures (Procedure States). In order to let gNB make decision on how to control the UE’.



- **Radio Condition states**: controlled by a NIDD flag of isRadioMonitorEnabled
  - **Idle**: means currently there is no any RRC Measurement Configured to UE
  - **RadioGood**: means UE in good radio condition and this is the default state after a UE comes into one cell via Initial Access, Incoming handover or Rrc Reestablishment.
  - **RadioAlarm**(only available when Radio Monitor Enabled): means UE in bad radio condition, triggered by a RRC Measurement Report on the event for radio condition monitor: enter coverage alarm event from a RadioGood UE
- **Procedure states (FFS):**
  - **VoiceFb**: means UE in voice fallback condition, triggered by voice service setup or release (PDU Session Resource Setup/Modify with 5QI1 for voice service setup/release).
  - **EcFb**: means UE in Emergency Fallback condition , triggered by IE of Emergency Fallback Indicator from AMF.
  - **Offload**: means UE in offload condition, trigger by load balance features on a UE.
- **Any**: for an incoming handover UE, or RRC Re-establishment UE, refer to the old measurement state, could be any of above measurement state.

Technical Details

Measurement Configuration Management—Measurement Purpose set

5G-CP-UE shall generate a "Measurement Purpose Set" based on the current Measurement State. Then according to measurement trigger, then can decide which measurement configurations are needed.

Purposes required by Radio Condition States:

Measurement purpose	RadoGood	RadioAlarm
IntraFreqMeas	Y	Y
LeaveAlarm	-	Y
EnterAlarm	Y	-
BlindRediret (SA)	Y	Y
SgnbRelease (NSA)	Y	Y
InterFreqMeas	-	Y
EutranMeas	-	Y

Purposes required by Procedure States:

Measurement purpose	VoiceFb	EcFb	Offload
IntraFreqMeas	-	-	-
LeaveAlarm	-	-	-
EnterAlarm	-	-	-
BlindRediret (SA)	Y	Y	-
SgnbRelease (NSA)	-	-	-
InterFreqMeas	-	-	Y
EutranHoMeas	Y	Y	-

Technical Details

Measurement Configuration Management—Measurement Report Config Info

5G-CP-UE shall manage a mapping table between measId and Measurement Report Info on each UE Measurement Context, every time after it generate RRC Measurement Configuration elements to UE. In order to help making handle decision when receiving RRC Measurement Report.

The Measurement Report Info shall including below information:

- **measId**: in the RRC MeasConfig IEs, will also present in the RRC Measurement Report message.

- **Measurement Type**: used to the measurement report handler make decisions. [5G_RAN_CP_34072]

- **Carrier Frequency**: in each MeasObject in the RRC MeasConfig IEs.

- **Measurement State**: indicate this Measurement elements is required by which Measurement State. [5G_RAN_CP_34547]

5G-CP-UE shall maintain Measurement id vs Measurement Type mapping table in UE context during measurement configuration

5G-CP-UE shall maintain 'allocated Measurement id vs Measurement Type (an enum with 0 being Intra-freq A3, 1 being Intra-freq A5)' mapping table in UE context during measurement configuration and this table needs to be referred while receiving Measurement report

MeasurementType	Enum Value
INTRA_FREQ_A3	0
INTRA_FREQ_A5	1
A1_DEACTIVE_INTER_FREQ	2
A2_ACTIVE_INTER_FREQ	3
INTER_FREQ_A3	4
INTER_FREQ_A5	5
A2_REDIRECTION	6
A2_SGNB_RELEASE	7
INTER_RAT_B2	8
OTHER	255

Technical Details

Measurement Configuration Management—Var Meas Config

5G-CP-UE shall manage a structure of VarMeasConfig on each UE Measurement Context. This structure stands for the whole Rrc Measurement Configuration elements at UE side. And shall keep in synchonization with UE.

varMeasConfig:

{

+ measIdList

+ measObjectList

+ reportConfigList

+ sMeasureConfig

+ quantityConfig

+ measGapConfig

}

NOKIA

Technical Details

Measurement Configuration Management—Measurement Profiles

5G-CP-UE shall set RRC Measurement Profiles based on the Network Environments, UE Capabilities and UE Conditions.

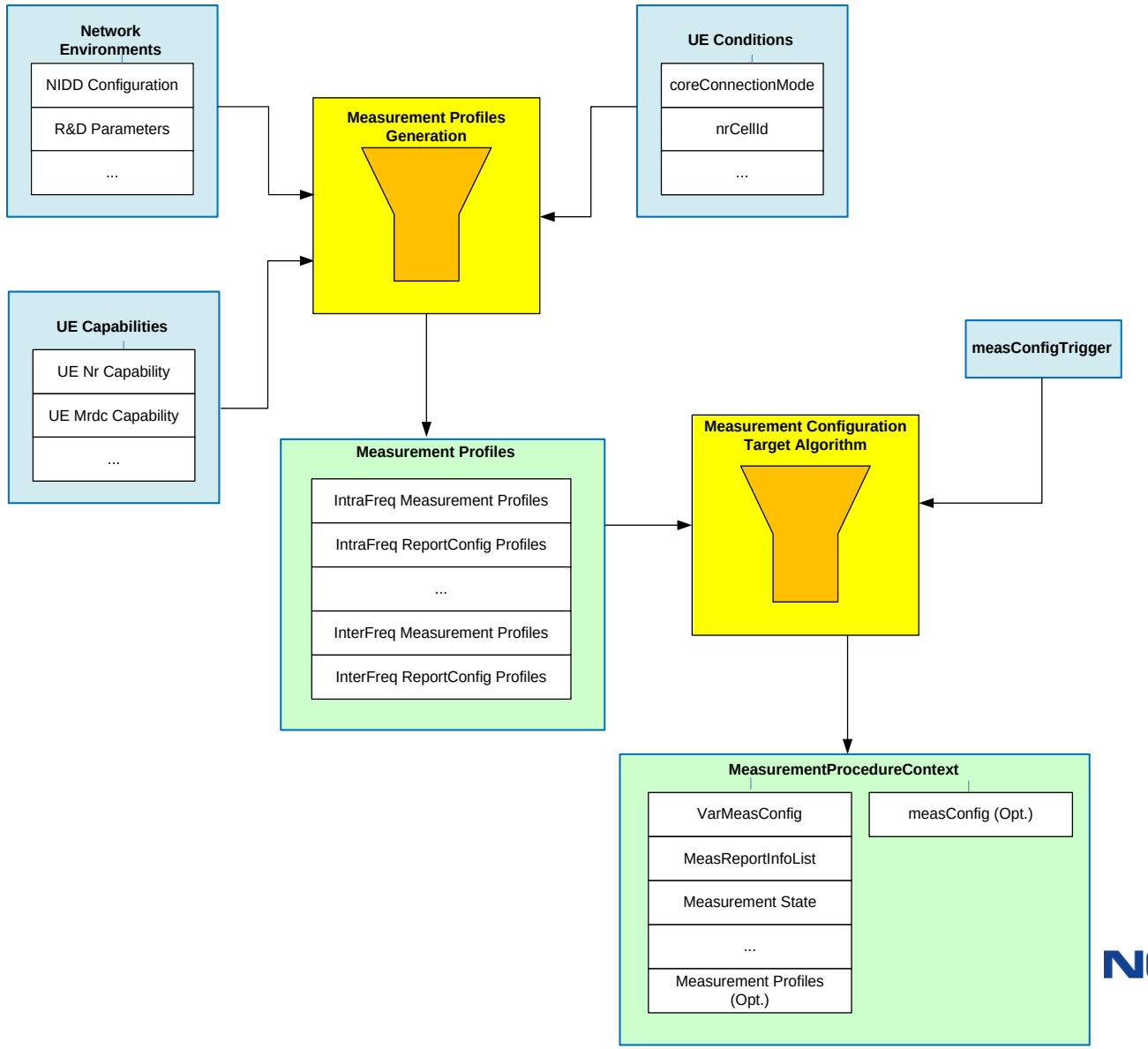
- Network Environments
  - NIDD Configurations
  - R&D Configurations
- UE Capabilities
  - UE Nr Capability
  - UE Mrdc Capability
  - Supported Band Combination List
- UE Conditions
  - coreConnectionMode
  - nrCellId

Technical Details

Measurement Configuration Management—Measurement Configuration Algorithm

initialMeasConfig:

5G-CP-UE shall provide a function to perform the first Rrc Measurement Configuration procedure for a new comming UE.

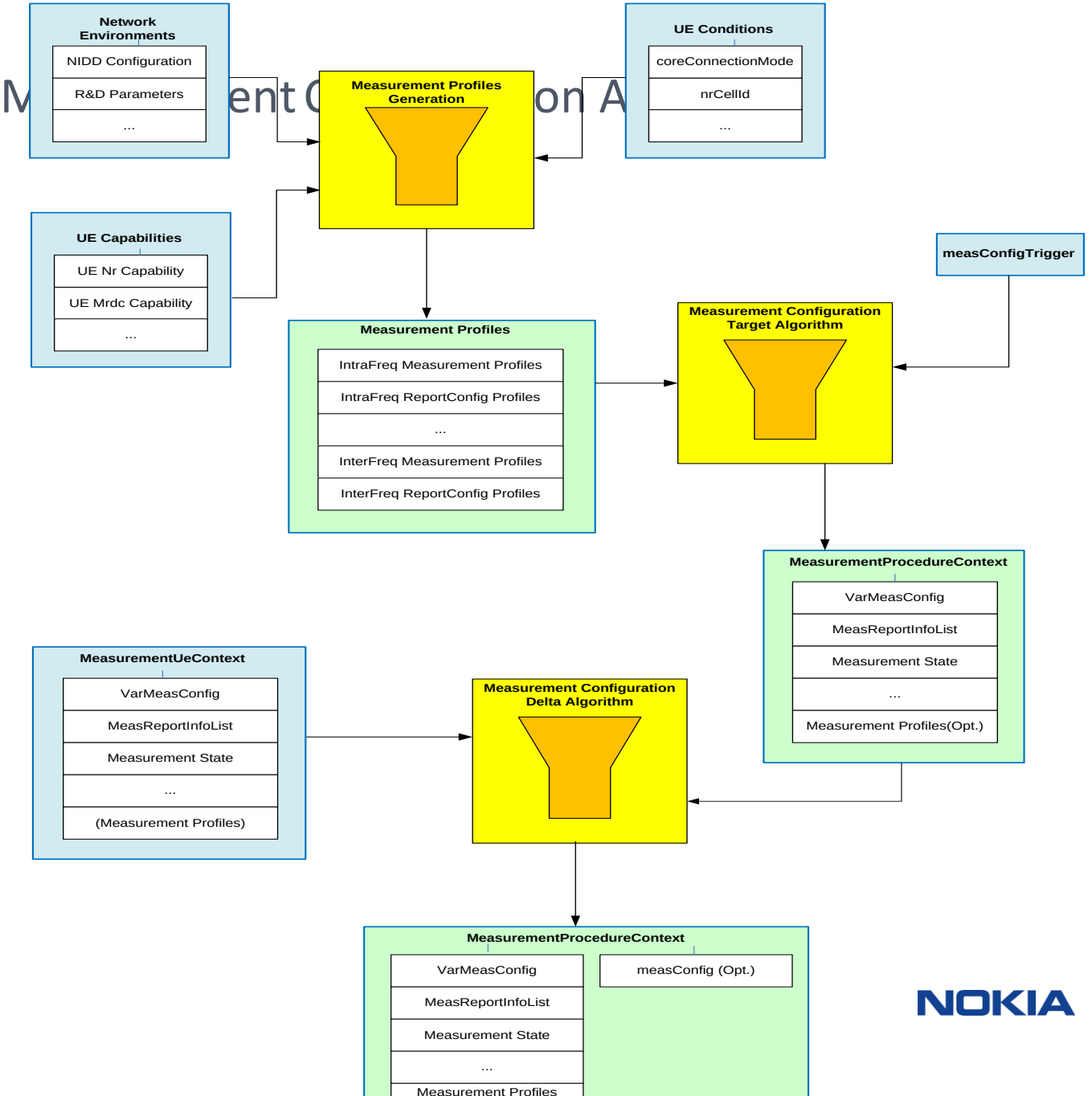


Technical Details

Measurement Configuration Management—M ent C on A

completeMeasConfig:

5G-CP-UE shall provide a function to perform the subsequent Rrc Measurement Configuration procedure for an exist UE, to update Rrc Measurement Configurations.



Technical Details

Measurement Configuration Management—Measurement Configuration ID

Measurement IDs(MeasObjectId, ReportConfigId and measId) shall be managed per RRC Measurement Configuration Procedure.

Each ID shall be allocated by a round robin allocator in range of [minId, maxId].

The default ID range is defined below:

- defaultMaxMeasId = 64;
- defaultMinMeasId = 1;
- defaultMaxMeasObjectId = 64;
- defaultMinMeasObjectId = 1;
- defaultMaxReportConfigId = 64;
- defaultMinReportConfigId = 1;

[5GC001095-A] (for NSA call)

{

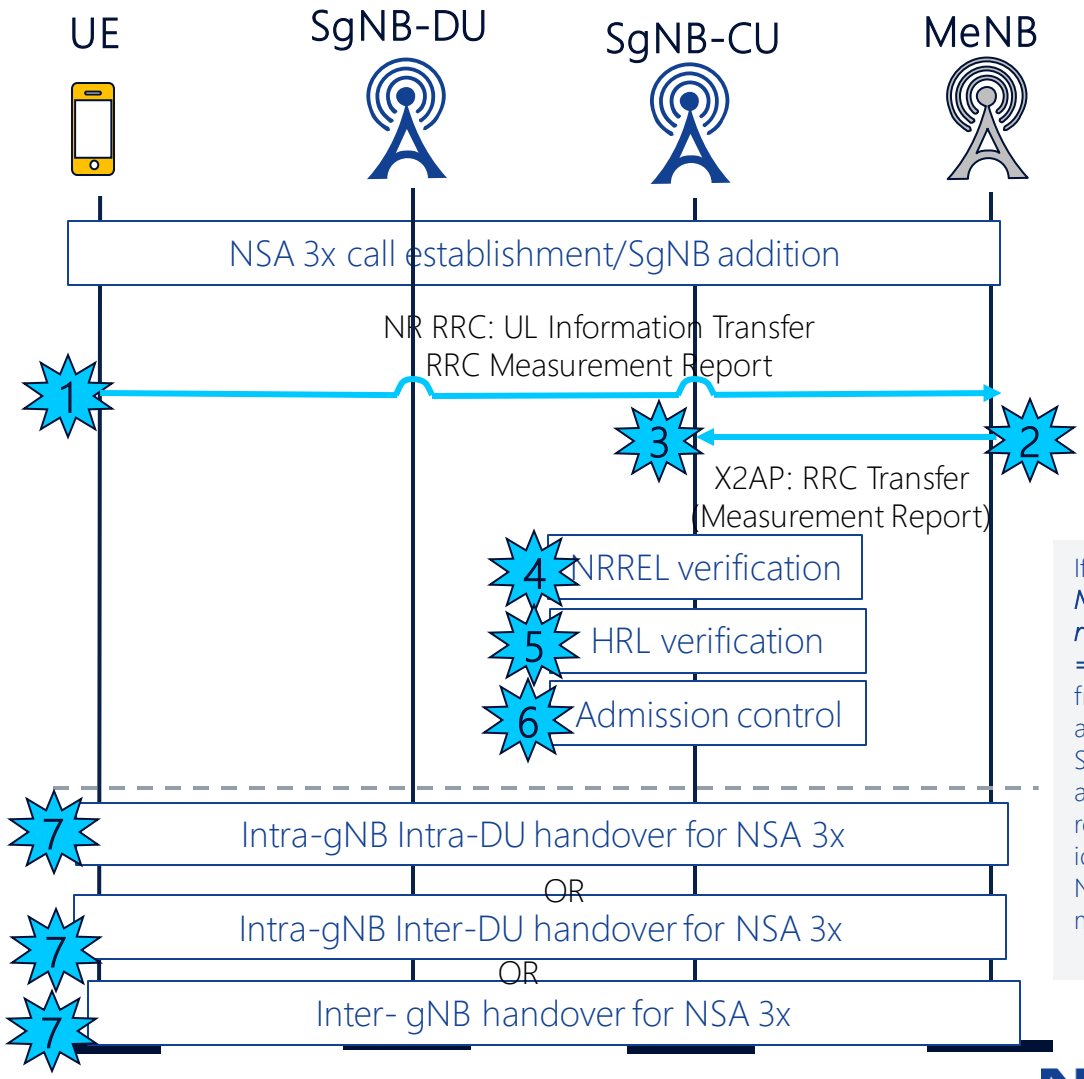
maxMeasId and maxMeasObjectId may comes from RRC IEs of ConfigRestrictInfoSCG. [5G_RAN_CP_32313] and [5G_RAN_CP_32314]

}

Technical Details

Measurement Report Handling for NSA 3x without SRB3

1. The UE sends to MeNB an LTE **RRC: ULInformationTransferMRDC** message, containing the ***ul-DCCH-MessageNR-r15*** IE, which itself contains **NR measurement report**. The measurement report doesn't include the blacklisted cells (configured by operator during SgNB addition procedure)
2. MeNB sends to gNB-CU **X2AP RRC Transfer** message which contains the *UENRMeasurement*
3. gNB-CU identifies the received Measurement Report as **A3/A5 Measurement Report** (based on the *measId* IE).
4. gNB-CU verifies which of the measured cells are configured as NRREL objects for the serving cell and are belonging to the same gNB
5. gNB-CU selects the strongest reported cell having PLMN that is allowed in the Handover Restriction List.
6. gNB-CU performs the Admission Control.
7. gNB-CU identifies a gNB/gNB-DU that the cell selected in Admission Control belongs to:
    1. If it is the same DU as that of the serving cell, the Intra-DU PSCell change procedure is initiated (5GC001094)
    2. If it is a different DU, the Inter-DU PSCell change procedure is initiated (5GC000572)
    3. If it is a different gNB, the Inter-gNB PSCell change procedure is initiated (5GC000573)

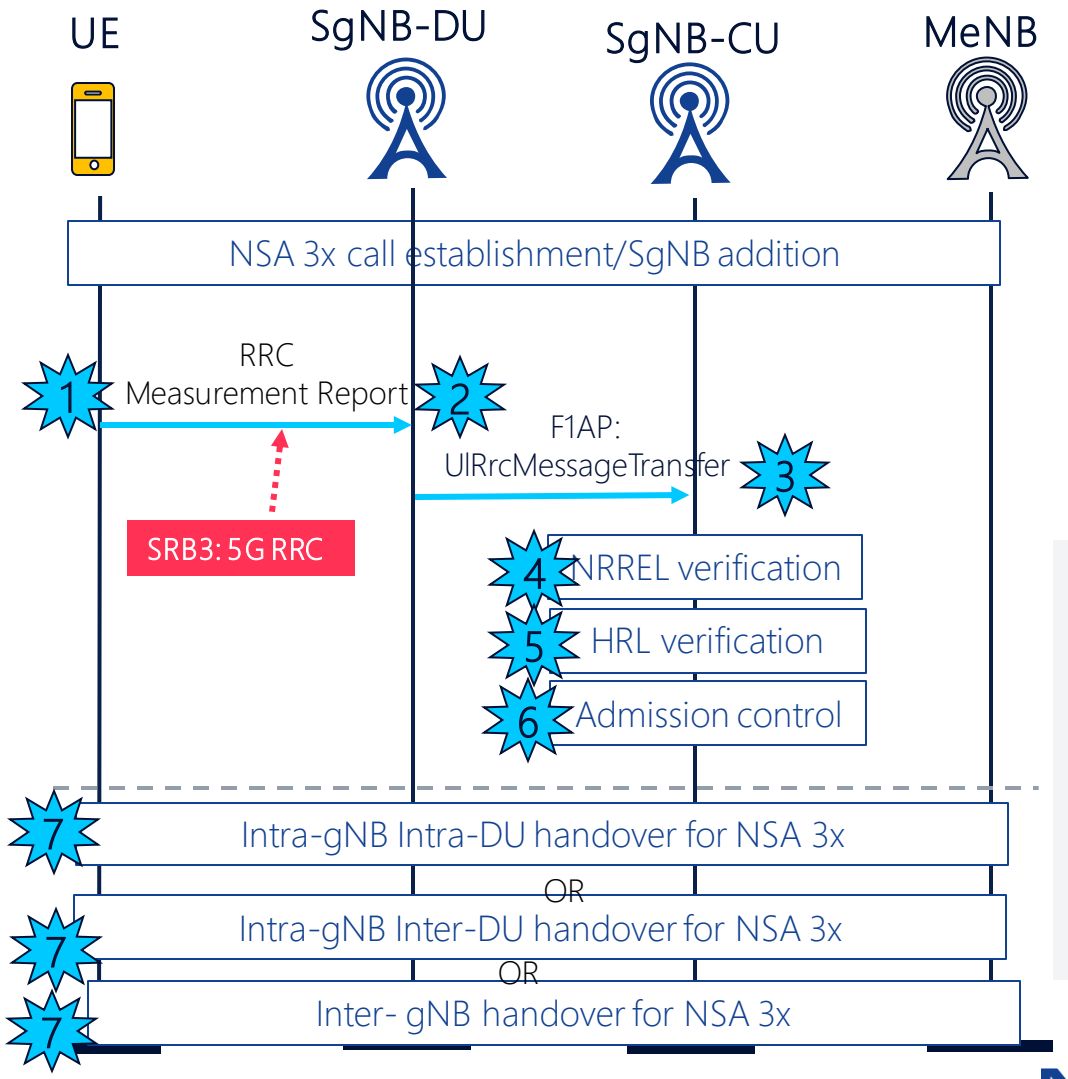


If ***MRBTS/NRBTS/actIntraFreqIntraGnbMobilityNSA = false*** meaning intra-frequency intra-DU and inter-DU intra SgNB mobilities are not allowed, gNB-CU removes the cell(s) identified as the local NR cell(s) from the measurement report.

NOTE: if the new measurement report is received before PSCell change is triggered, SgNB-CU should abort ongoing handling for old measurement report and deal with newest measurement report. If the new measurement report is received when PSCell change is already ongoing, SgNB-CU should ignore received measurement report.

Technical Details
Measurement Report Handling for NSA 3x with SRB3

1. gNB-DU receives the **RRC: Measurement** report for A3/A5 event.
2. gNB-CU receives the measurement report from gNB-DU within F1AP: UlRrcMessageTransfer.
3. gNB-CU identifies the received Measurement Report as **A3/A5 Measurement Report** (based on the ***measId*** IE).
4. gNB-CU verifies which of the measured cells are configured as NRREL objects for the serving cell and are belonging to the same gNB
5. gNB-CU selects the strongest reported cell having PLMN that is allowed in the Handover Restriction List.
6. gNB-CU performs the Admission Control.
7. gNB-CU identifies a gNB/gNB-DU that the cell selected in Admission Control belongs to:
    1. If it is the same DU as that of the serving cell, the Intra-DU PSCell change procedure is initiated (5GC001094)
    2. If it is a different DU, the Inter-DU PSCell change procedure is initiated (5GC000572)
    3. If it is a different gNB, the Inter-gNB PSCell change procedure is initiated (5GC000573)



If ***MRBTS/NRBTS/actIntraFreqIntraGnbMobilityNSA = false*** meaning intra-frequency intra-DU and inter-DU intra SgNB mobilities are not allowed, gNB-CU removes the cell(s) identified as the local NR cell(s) from the measurement report.

NOTE: if the new measurement report is received before PSCell change is triggered, SgNB-CU should abort ongoing handling for old measurement report and deal with newest measurement report. If the new measurement report is received when PSCell change is already ongoing, SgNB-CU should ignore received measurement report.

Technical Details
Selection of a target cell

- The en-gNB supports neighbor relations on a per PSCell basis which point to neighbor 5G cells. The neighbor relations are configured on a per PSCell basis.
  - Neighbor relations to neighbor cells are operator configurable containing e.g. the neighbor cell PCI and cell individual offset.
  - PCI confusion may become an issue with large number of gNB cells. This feature assumes no PCI confusion or PCI has uniquely resolved to a target cell

MRBTS/NRBTS/NRCELL/NRREL

If Radio Admission Control mechanism to the selected target PSCell fails (e.g. due to lack of resources), the en-NB selects the next strongest target from the measurement report to try to attempt the cell access. The en-gNB continues to do so on until the target list is exhausted.
NOTE: the selected target cell may result in either an intra-SgNB or inter-SgNB PSCell change (5GC000572 or 5GC000573 rather that only 5GC001094 – there are no feature –specific A3/A5 measurements)

PSCell change procedure does not need to be coordinated by MeNB

Possible PSCell change failure cases:
- $T_{DCoverall}$ Expiry
- T304 expiry (*not scope of 5GC001094 – supported by 5GC001829)
- RLF happens
- target cell resource allocation failure
- MeNB refusal

Technical Details
Cell quality check(1)

- For RSRP mode, RSRQ mode and 'RSRP and RSRQ mode', 5G-CP-UE would regard the cell list is already in descending sorted by UE side (3GPP spec will ensure this). 5G-CP-UE would directly forward the list to 5G-CP-CELL for Admission Control.

- In the case where the NIDD parameter a3MeasEnabled is set to “RSRPCombined” or “RSRQCombined” combined, the 5G-CP-UE shall remove the cells from the HO candidate cells for admission control which do not comply with the following criteria:
  - Mn - Hys > Mp + Off

If configured measurement is RSRPCombined
[PR491286]
Mn is the (RSRQ measurement reported by the UE for the neighbor cell -87)/2
Mp is the (RSRQ measurement reported by the UE for the source cell - 87)/2
Hys is the NIDD parameter a3HysteresisSsbRsrq/2
Off is the NIDD parameter a3OffsetSsbRsrq/2
[End PR491286]

If configured measurement is RSRQCombined
[PR491286]
Mn is the RSRP measurement reported by the UE for the neighbor cell - 156
Mp is the RSRP measurement reported by the UE for the source cell - 156
Hys is the NIDD parameter a3HysteresisSsbRsrp/2
Off is the NIDD parameter a3OffsetSsbRsrp/2
[End PR491286]

Technical Details

Handover Restriction List (HRL)

Handover Restriction List (HRL): During selection of candidate cells for SgNB (in case of SgNB addition or handover procedure) UE need to check whether the **PLMN of candidate cell** belongs to HRL.

The HRL can be received in **SgNB Modification Request** or **SgNB Addition Request** message. Any HRL received in SgNB Addition Request will be overwriten by HRL received in SgNB Modification Request . gNB-CU stores the HRL information in the UE context and uses it when finding a target cell for the UE during an event related to mobility scenarios:

- SgNB addition
- Intra-gNB HO
- SSCell addition during HO
- Inter-SgNB HO preparation by source

gNB-CU checks the PLMN info of the candidate neighboring cells to verify whether it is equal to serving PLMN or equivalent PLMN included in Handover Restriction List

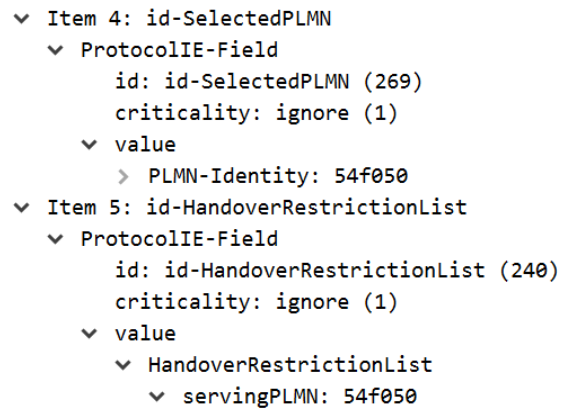
If 5GC000738 Multiple PLMN ID support is available (5G19A)

PLMNs assigned to each neighbor cell are defined by parameters:
MRBTS/NRBTS/NRCELL/NRREL.gnbPlmn or MRBTS/NRBTS/NRCELL/NRREL.plmnList

If 5GC000738 Multiple PLMN ID support is available (5G19A)

Technical Details

Select the strongest neighbor cell assigned to allowed PLMN



5G-CP-UE shall consider all cells candidates from measurement report to select the strongest one assigned to proper PLMN based on following prioritization method

- PLMNs allowed for particular UE are defined by MeNB during SgNB Addition and SgNB Modification request by following optional parameters:
  - *selected PLMN*
  - *Handover Restriction List*
  - *-> Serving PLMN*
  - *-> Equvalent PLMNs*

a) 5G-CP-UE compares each PLMN assigned to the cell candidate with *selected PLMN* (if parameter is not present then skip to another step).

b) 5G-CP-UE compares each PLMN assigned to the cell candidate with *Handover Restriction List -> Serving PLMN* (if parameter is not present then skip to another step).

c) 5G-CP-UE compares each PLMN assigned to the cell candidate with *Handover Restriction List -> Equivalent PLMNs* (if parameter is not present then skip to another step).

d) If Handover Restriction List is not defined for particular UE then 5G-CP-UE shall select the strongest cell without validating PLMN. If there is no cell selected according to these rules then PLMN validation is failed for cell selection and HO procedure should be rejected.

PLMNs assigned to each neighbor cell are defined by parameters:
MRBTS/NRBTS/NRCELL/NRREL.gnbPlmn or MRBTS/NRBTS/NRCELL/NRREL.plmnList

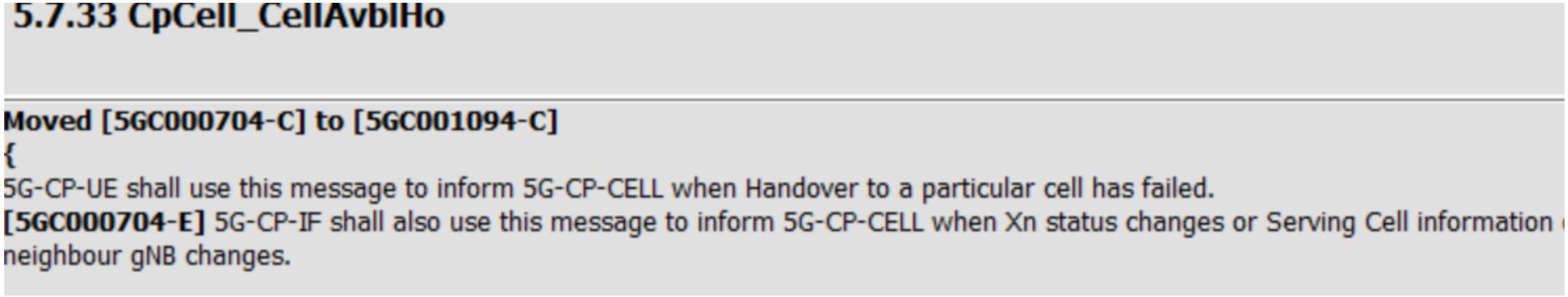
If 5GC000738 Multiple PLMN ID support is available (5G19A)

Technical Details

Temporary Blacklisting(1)

5G-CP-CELL shall maintain Availability status Neighbour cells

- 5G-CP-CELL shall maintain the "Availability" status of Neighbour cells which indicate whether a Handover can be initiated for a given neighbour cell. 5G-CP-CELL shall maintain this in the SDL.
- When 5G-CP-CELL receives CpCell_CellAvlbHo (5G_RAN_CP_19891) from 5G-CP-UE, 5G-CP-CELL shall mark that NRREL cell as "Unavailable" (Note that 5G-CP-CELL shall also mark a NRREL Cell as "Unavailable" if Admission control fails for that target cell.) for a period of time configured by the NIDD parameter MRBTS/NRBTS/NRCELL/blockHoTimer, and during this period this unavailable cell should not be selected as target cell for HO.



Technical Details

Temporary Blacklisting(2)

5G-CP-UE shall inform 5G-CP-CELL of Handover failure

5G-CP-UE shall inform 5G-CP-CELL of Handover failure to a cell if MRBTS/NRBTS/NRCELL/blockHoTimer >0 and if Handover has failed for the following reasons:

- F1AP: UE Context Setup Failure is received with cause "Misc. Miscellaneous Cause. Not enough User Plane Processing Resources" or "Radio Network Layer. Radio Network Layer Cause. Unspecified"

- F1AP: UE Context Modification Failure is received with cause "Misc. Miscellaneous Cause. Not enough User Plane Processing Resources" or "Radio Network Layer. Radio Network Layer Cause. Unspecified" in case of Intra-gNB Intra-DU HO.

- E1AP: Bearer Context Modification Failure is received during Handover procedure in case of Intra-gNB HO.

- XnAP: Handover Peparation Failure is received with cause "Radio Network Layer. Radio Network Layer Cause.Handover Target not Allowed" or "Radio Network Layer. Radio Network Layer Cause.No Radio Resources Available in Target Cell" or "Misc. Miscellaneous Cause. Not enough User Plane Processing Resources" **[Before 5GC001008-W] [5GC001008-J]** or "Slice not supported by NG-RAN" **[5GC001008-W]** or "Slice(s) not supported by NG-RAN".

Other cause values received shall not result in marking cell as "Unavailable".

[5GC001094-C] For Intra-DU PSCell change, only F1AP: UE Context Modification Failure and E1AP: Bearer Context Setup Failure mentioned above are used.

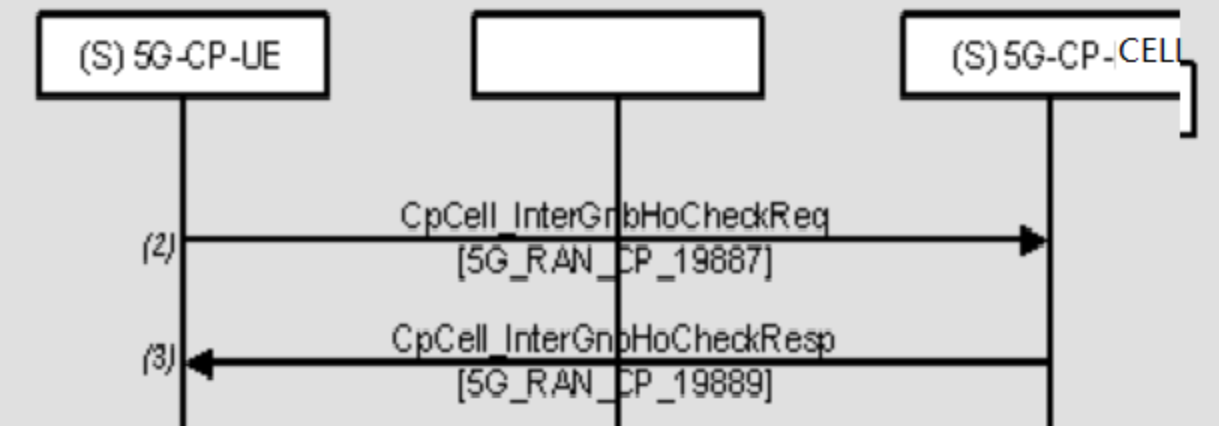
[5GC000573-C] { The refuse cause value is used by 5G-CP-CELL to blacklist a cell [5G_RAN_19907] when:

Technical Details

Temporary Blacklisting(3)

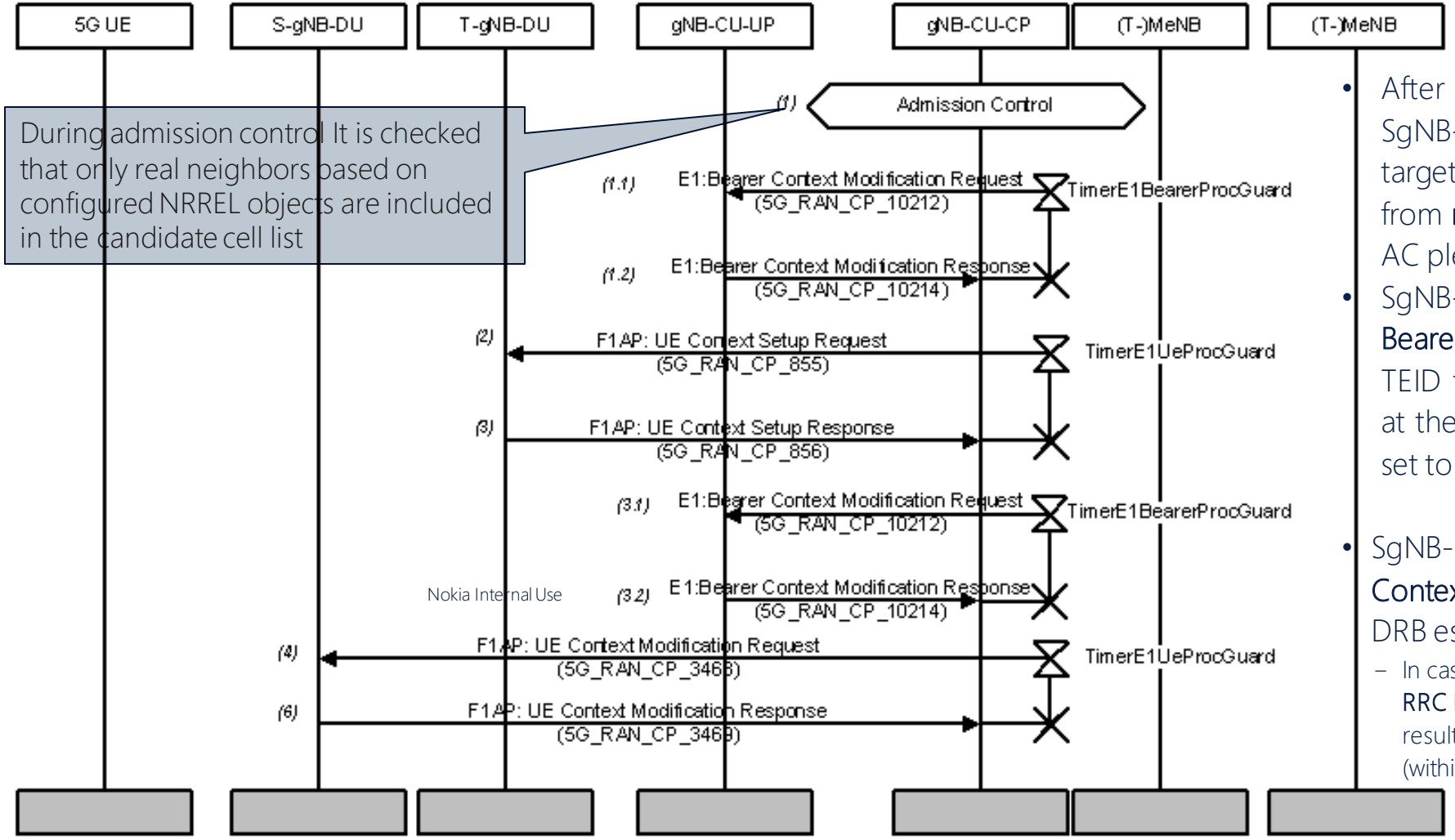
For intra-gNB handover, temporary black list is used in CPCELL during RAC admission

For inter-gNB handover, temporary black list is used in CPUE during selection of target cell



Technical Details

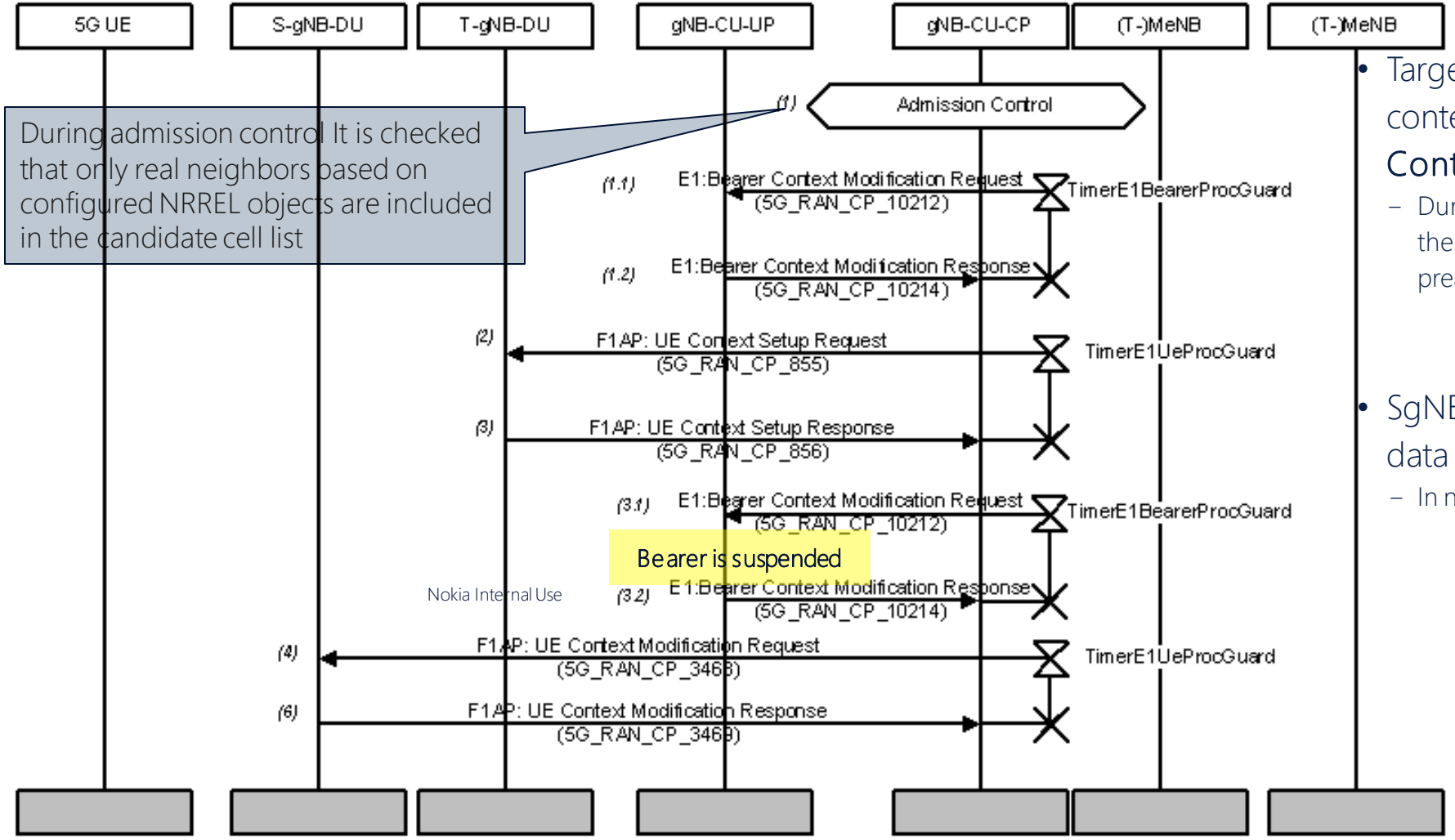
Intra-Frequency Inter-DU PSCell change preparation(1/3)—5GC000572



- After receiving measurement report from UE, SgNB-CU performs Admission Control (AC) for target cell based on candidate cell list (obtained from **measResultListNR** IE). For more details about AC please refer to 5GC000480
- SgNB-CU-CP requests SgNB-CU-UP via **E1AP: Bearer Context Setup Request** to allocate F1-U TEID for the target DU for Handover Preparation at the target: New UL TNL Information Required is set to "required"
- SgNB-CU requests Target SgNB-DU via **F1AP: UE Context Setup Request** to perform UE context and DRB establishment
  - In case of contention free random access (CFRA) **CU to DU RRC Information** IE contains beam level RSRP measurement results for preamble allocation for UE in Target gNB-DU (within **CandidateRS-IndexInfoListSSB**)

Technical Details

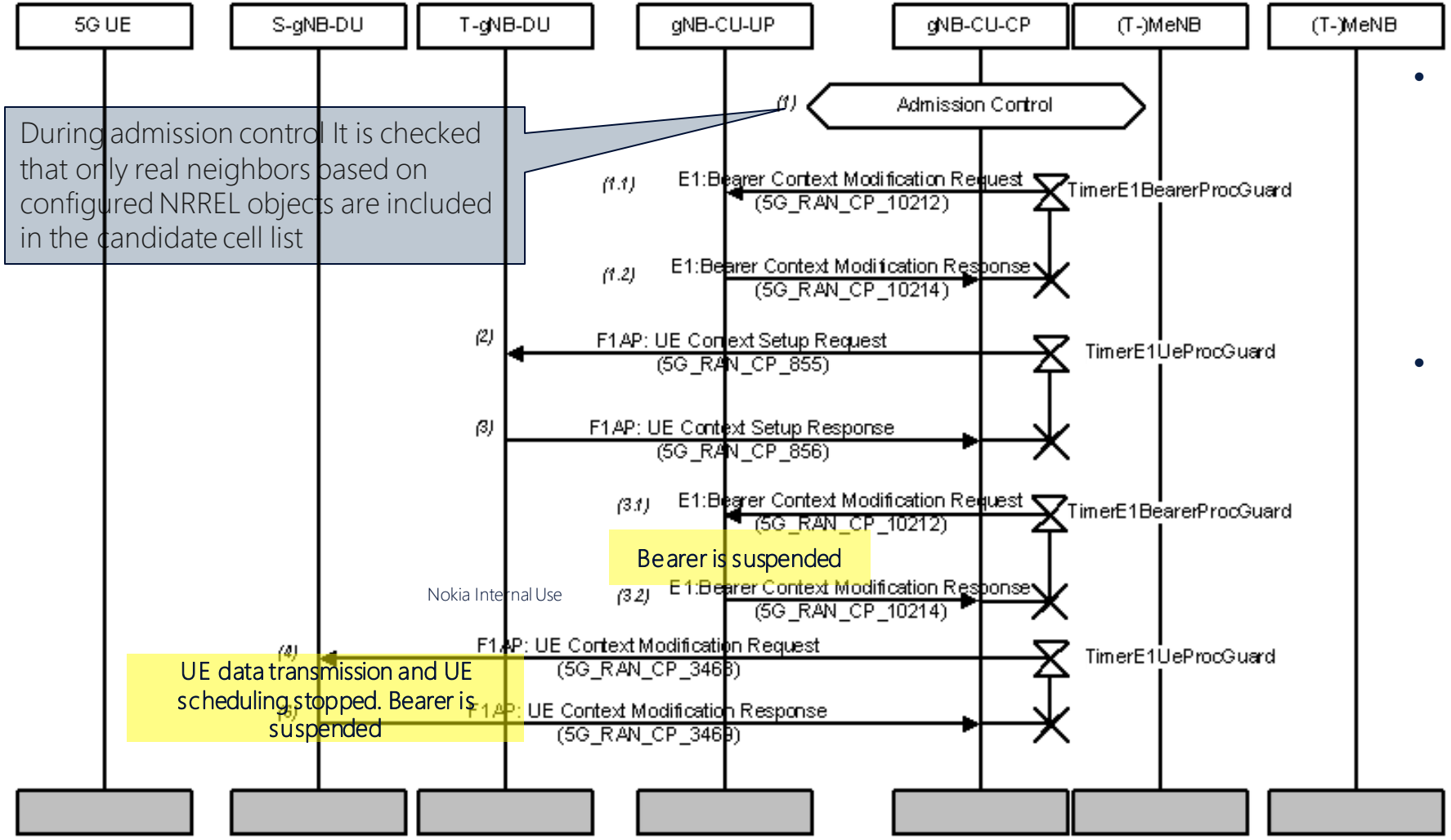
Intra-Frequency Inter-DU PSCell change preparation(2)/3—5GC000572



- Target gNB-DU confirms successful UE context and DRB establishment via **F1AP: UE Context Setup Response**
  - During CFRA case **DU to CU RRC Information** IE contains the **RACH-ConfigDedicated** IE including the allocated preamble for each beam index to be used by UE
- SgNB-CU-CP requests CU-UP to suspend data over Source DU, also with
  - In new F1-U TEID allocated by target DU)

Technical Details

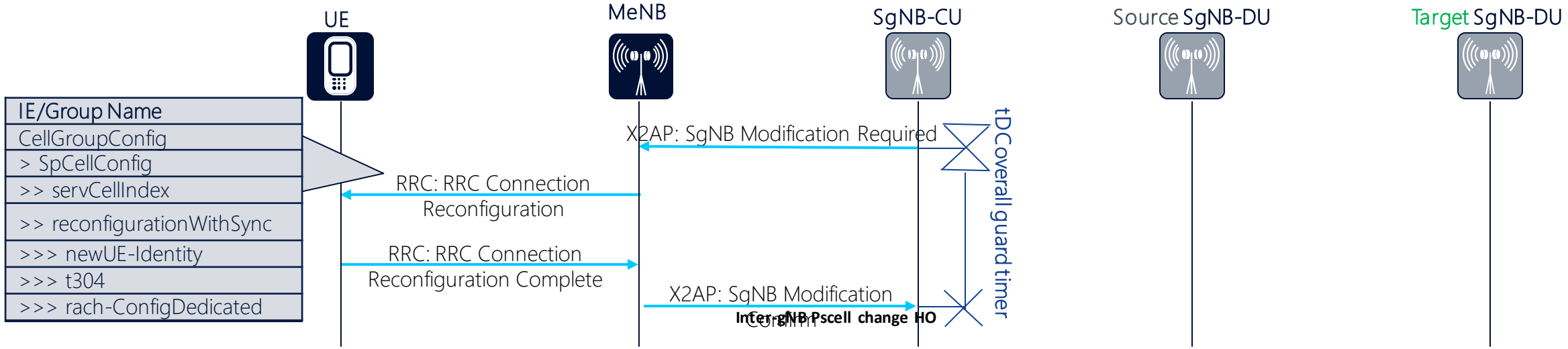
Intra-Frequency Inter-DU PSCell change preparation(3/3)—5GC000572



- SgNB-CU requests Source gNB-DU to stop UE data transmission and UE scheduling by including the **Transmission Stop Indicator** IE within **F1AP: UE Context Modification Request**.
- Source SgNB-DU confirms successful data transmission and UE scheduling stop via **F1AP: UE Context Modification Response**
  - DRB is suspended in **SgNB-CU** and PDCP SDUs are buffered
  - to improve data delivery reliability in DL when HO is ongoing SgNB can be allowed to send **duplicate PDCP PDU** (controlled via *NRBTS/actDataDuplicationForMobility* value transmitted during bearer suspend procedurę within SgNB CU)

Technical Details

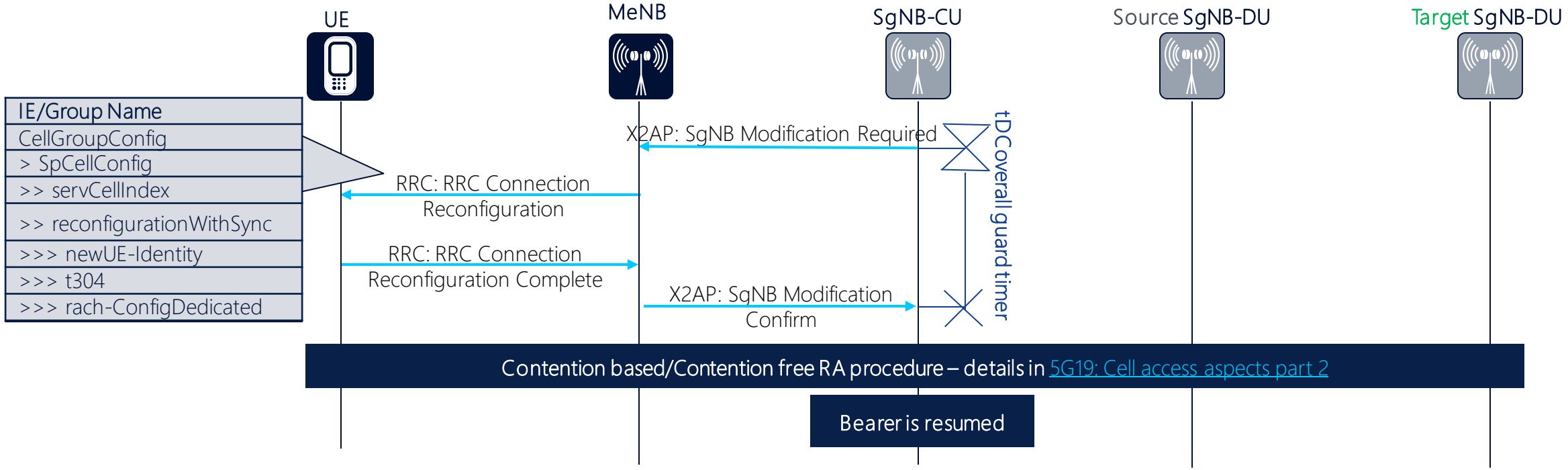
Intra-Frequency Inter-DU PSCell change execution without SRB3 (1/2)-- 5GC000572



- PSCell change is triggered by sending **X2AP: SgNB Modification Required** message to MeNB containing **the RRC Connection Reconfiguration** which defines for UE:
  - the target **PhysCellId** (via **servCellIndex** IE)
  - new **C-RNTI** (via **newUE-Identity** IE)
  - Timer **T304** (set to the value of *NRBTS/t304*) - to guard the success of PSCell Change.
  - allocated **preamble** for each beam index to be used by UE during CFRA (**RACH-ConfigDedicated** IE)
- **TDCoverall** timer (controlled by *NRBTS/tDCoverall*) is started after sending the **X2AP: SgNB Modification Required** message
- After completion of **RRC Connection Reconfiguration**, MeNB forwards the **RRC Connection Reconfiguration Complete** message to the SgNB within the **X2AP: SgNB Modification Confirm**.
- **TDCoverall** timer is stopped after reception of the X2AP message

Technical Details

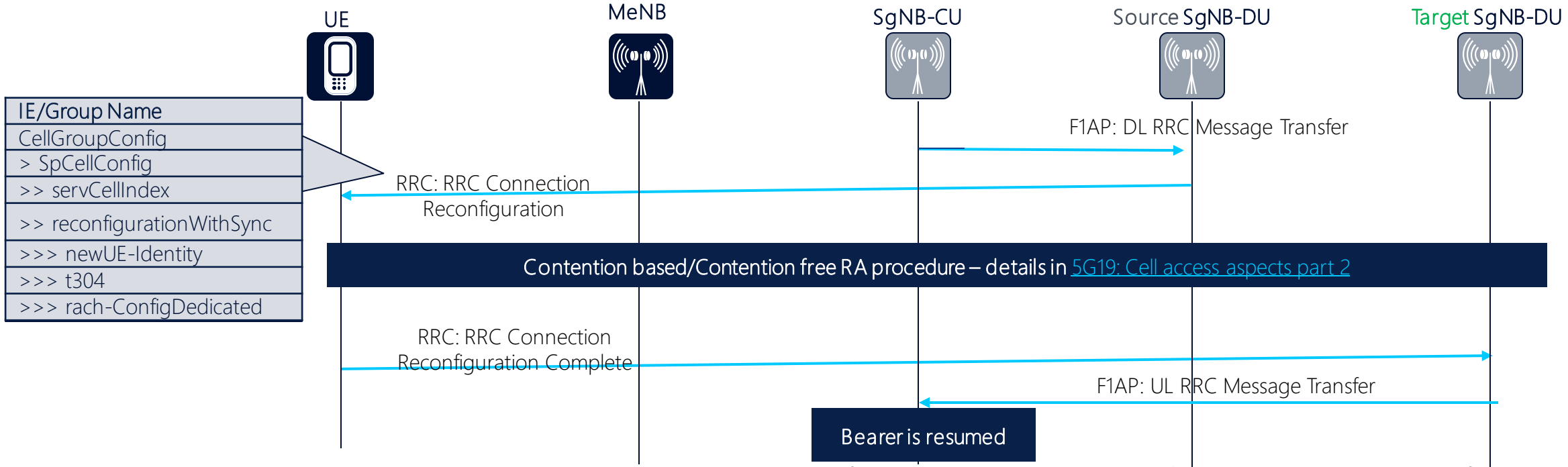
Intra-Frequency Inter-DU PSCell change execution without SRB3 (2/2)--5GC000572



- UE performs either **contention free random access** (CFRA) or **contention based random access** (CBRA) using proper beam transmitting SS/PBCH block (SSB), according to the following order:
  1. If CFRA is configured – *NRCELL/cbPreamblesPerSsb* < 64 (UE is given with preamble per beam) AND **SS-RSRP** > *NRCELL/rsrpThresholdSSB* → CFRA
  2. If CFRA could not be performed (no dedicated preambles available, e.g. *NRCELL/cbPreamblesPerSsb* = *64* or above RSRP condition not met) AND **SS-RSRP** > *NRCELL/rsrpThresholdSSB* → CBRA
  3. Otherwise any beam is selected → CBRA

Technical Details

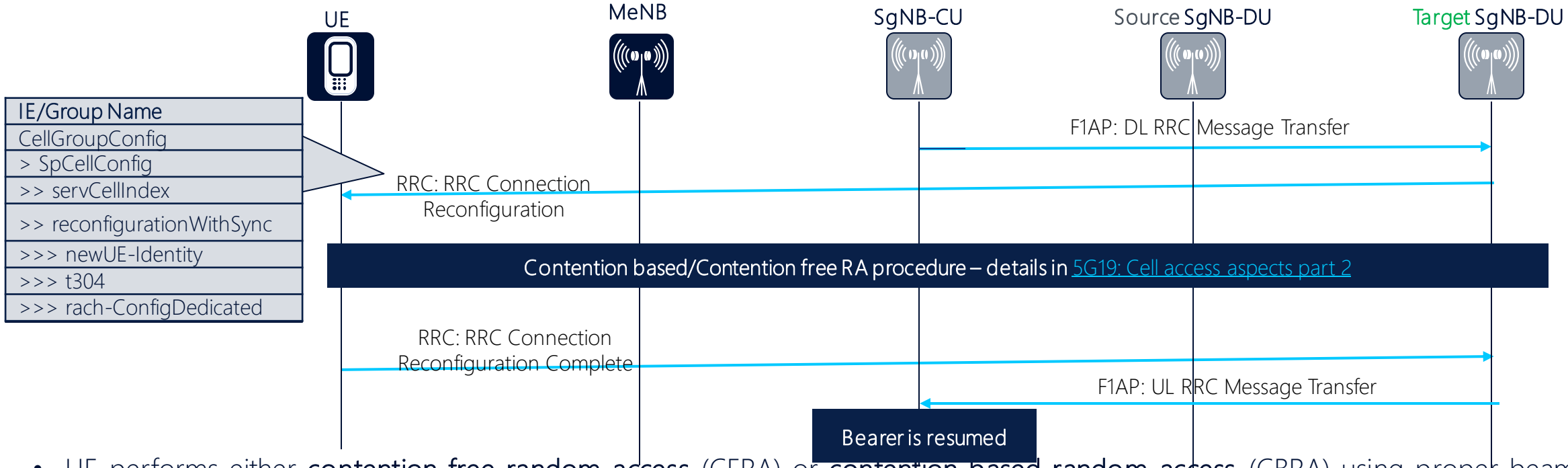
Intra-Frequency Inter-DU PSCell change execution with SRB3 (1/2)--5GC000572



- PSCell change is triggered by sending **F1AP: DL RRC Message Transfer** to Source DU containing **the RRC Connection Reconfiguration** which defines for UE:
  - the target **PhysCellId** (via **servCellIndex** IE)
  - new **C-RNTI** (via **newUE-Identity** IE)
  - Timer **T304** (set to the value of *NRBTS/t304*) - to guard the success of PSCell Change.
  - allocated **preamble** for each beam index to be used by UE during CFRA (**RACH-ConfigDedicated** IE)

Technical Details

Intra-Frequency Inter-DU PSCell change execution with SRB3 (2/2)--5GC000572



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  2. If CFRA could not be performed (no dedicated preambles available, e.g. *NRCELL/cbPreamblesPerSsb* = *64* or above RSRP condition not met) AND **SS-RSRP** > *NRCELL/rsrpThresholdSSB* → **CBRA**
  3. Otherwise any beam is selected → **CBRA**

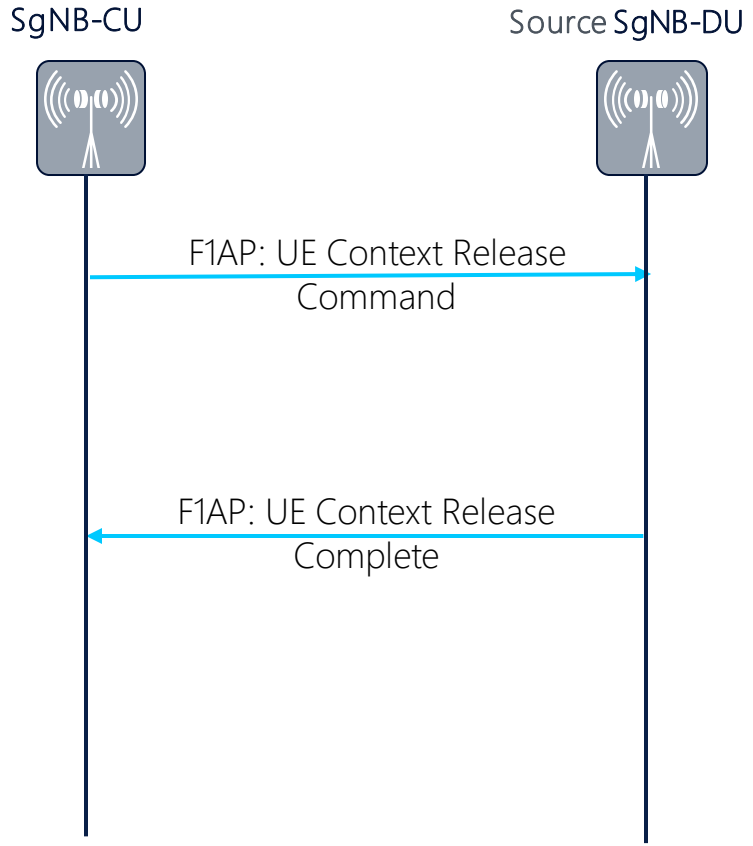
- UE send RRC Reconfiguration Complete to Target cell(target DU), Target DU forward the message to CU via F1AP: UL RRC Message Transfer

Technical Details

Intra-Frequency Inter-DU PSCell change completion --5GC000572

- SgNB-CU requests Source gNB-DU to release the old UE context via **F1AP: UE Context Release Command**
- Source SgNB-DU acknowledges the successful release of the context sending **F1AP: UE Context Release Complete**

- Upon successful completion of a CFRA PSCell Change, the target SgNB-DU releases any dedicated preambles that were allocated to the UE



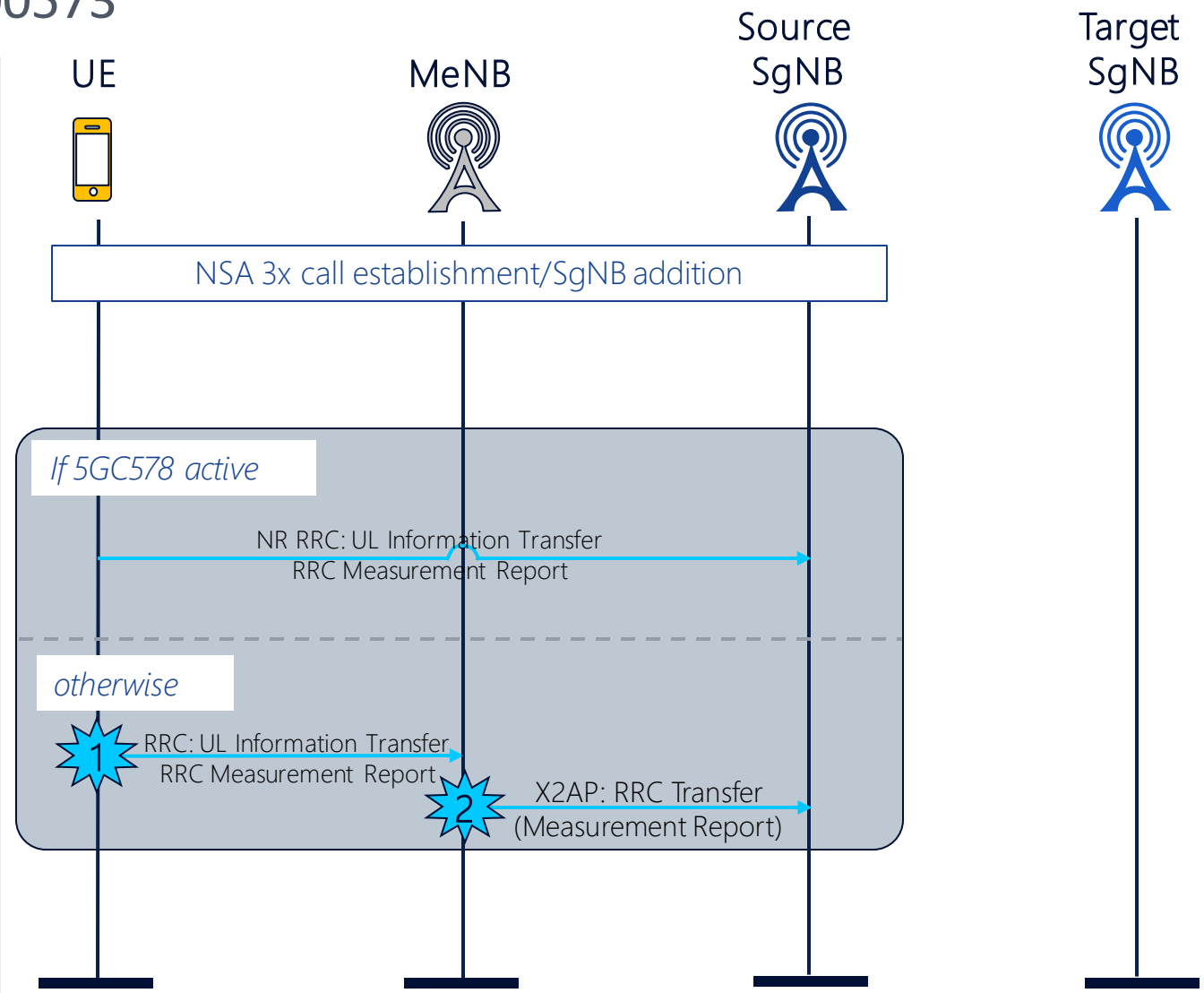
Technical Details

Inter-gNB PSCell change decision--5GC000573

Initial Step: NSA 3x Call establishment. After call establishment procedure the UE is the DC UE in EN-DC architecture : connected to one LTE cell and one 5G cell. SgNB addition procedure is used.

If **5GC000578** is active (*MRBTS/NRBTS/srb3SupportEnabled = true*) then the Measurement Report is sent directly from UE to Source SgNB

1. By default 5G NSA call **uses MCG SRB1signalling**. It means that measurement report is transmitted first to MeNB and then MeNB is forwarding the report to Source SgNB.
2. The Measurement Report provides results for intra-frequency mobility via *measResults IE* with encapsulated *measResultListNR*. It contains:
   - The list of HO candidate cells (each one defined via MeasResultNR IE).The list may also be empty, in that case no handover is attempted.
   - The cells are ordered by RSRP/RSRQ (depending on trigger quantity) - strongest one being the first.
   - The max number of reported cells is specified via maxCellReport IE (in 5G19A hardcoded to 8)



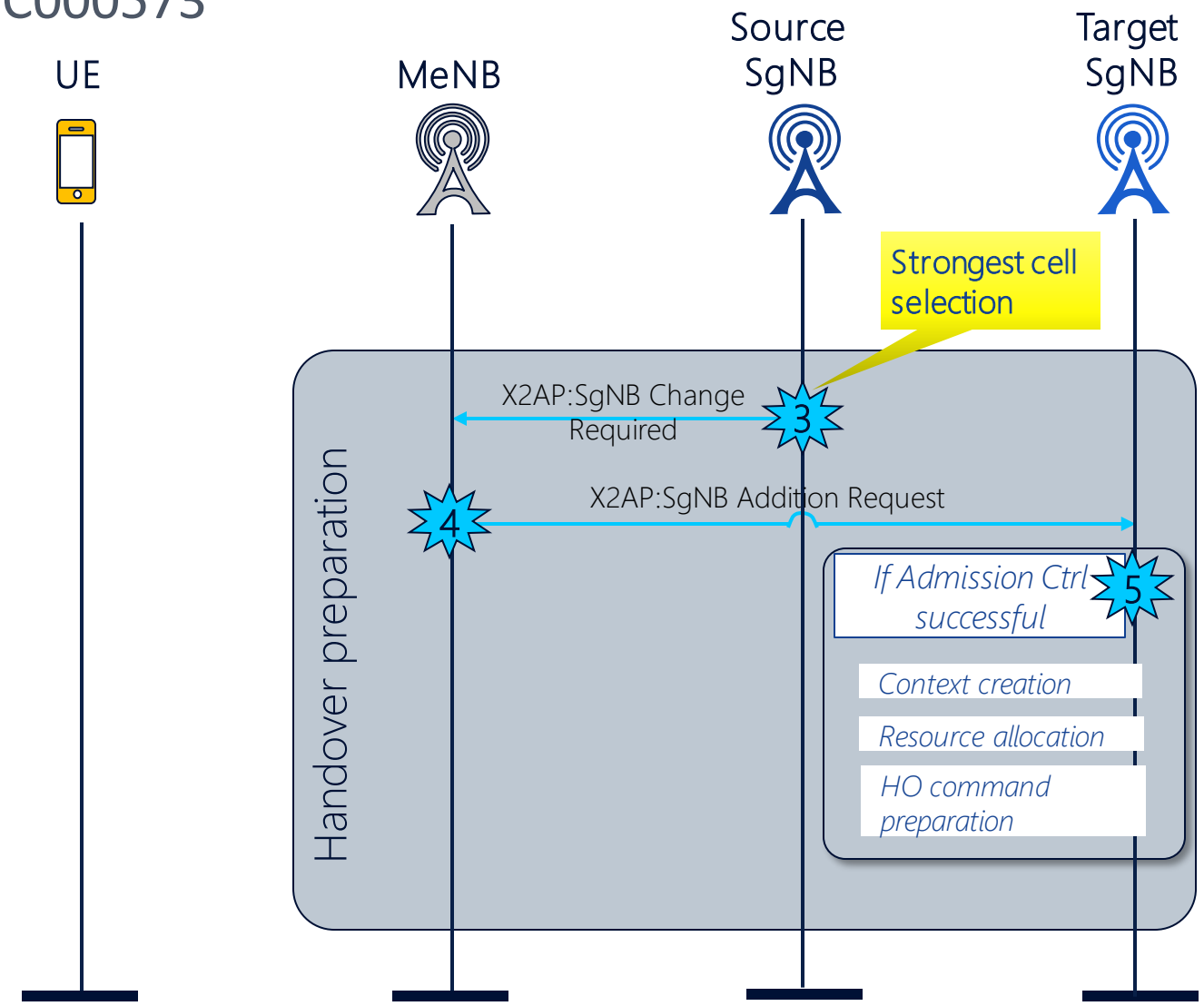
Technical Details

Inter-gNB PSCell Change preparation—5GC000573

3. The **SgNB** reads the measurement report and selects the strongest 5G cell and then initiates PSCell change procedure with *X2AP: SgNB Change Required*. The message contains:
   - X2AP UE ID
   - The NR radio configuration
   - The list of candidate traget cells and the cause

4. The **MeNB** decodes the msg#3, identifies and prepares the target SgNB cell by sending *X2AP: SgNB Addition Request* towards target SgNB-CU.

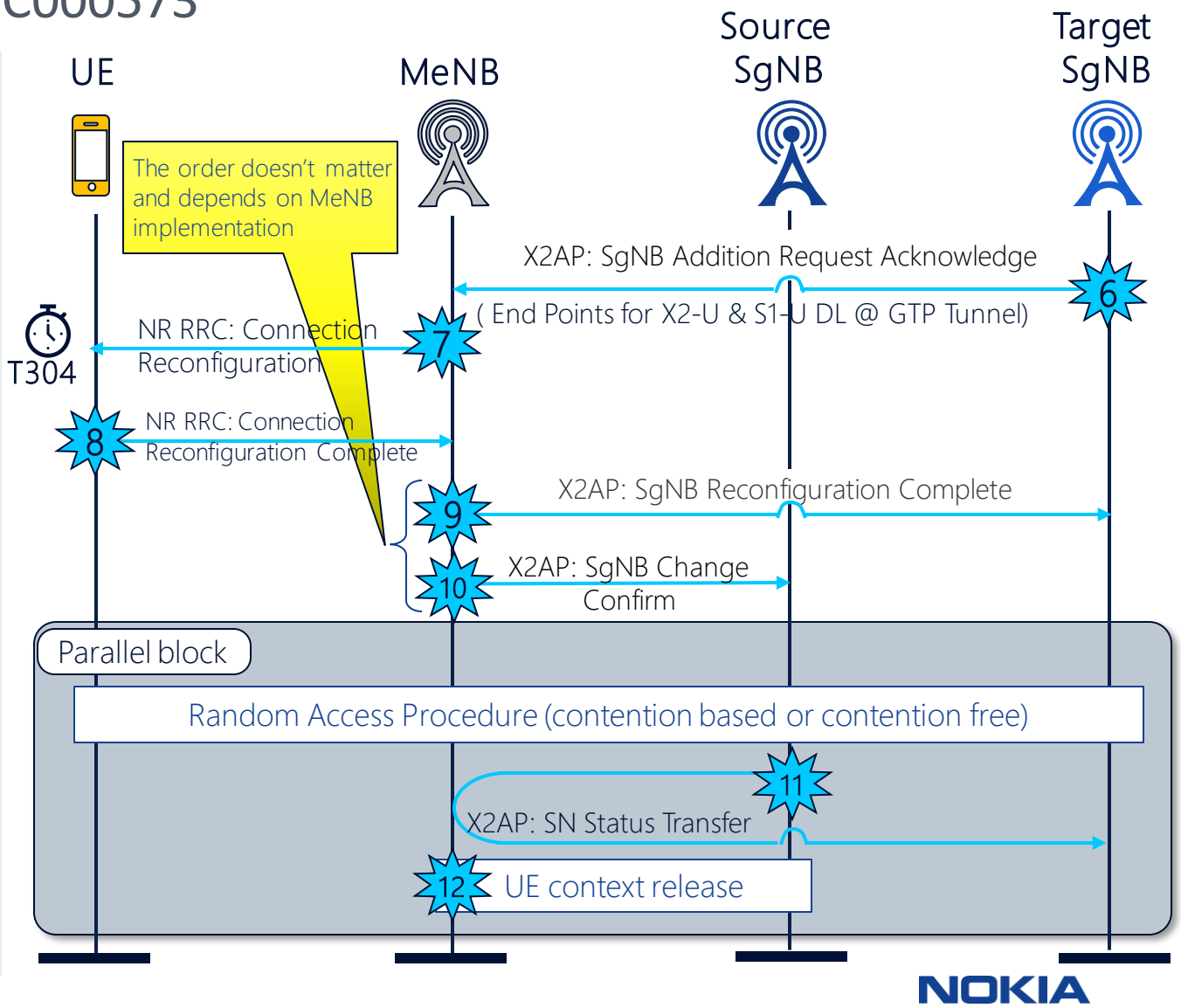
5. Target **SgNB** receives the request and identifies that the message calls for inter en-gNB HO based on *X2AP SgNB Adition Trigger Indication IE*.
   - Target SgNB applies admission control procedure. If succesfull, then Target creates Berear and UE context and allocates resources.
   - The target SgNB prepares the *RRC: RRCReconfiguration* message as for NSA HO command. The RRC radio configuration contains the target physical cell Id, the SCells ID (if needed), the new C-RNTI, the target cell RACH parameters in case of contention free RA selection and the measurement configuration in the target PSCell. Target SgNB may apply blacklisting of the candidate target cell.



Technical Details

Handover execution and completion –5GC000573

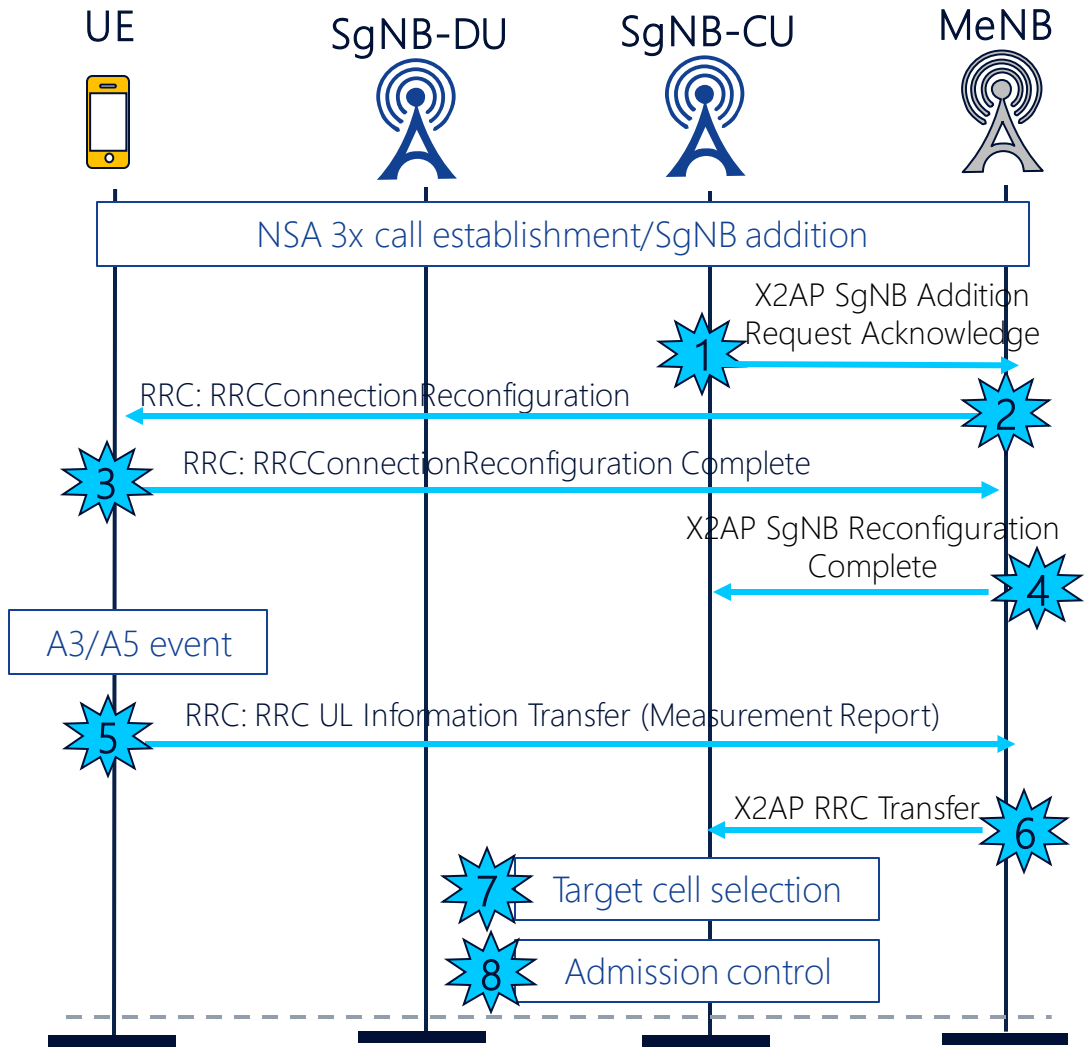
6. Target **SgNB** acknowledges the **SgNB Addition procedure** to MeNB via *X2AP: SgNB Addition Acknowledge*. The message includes also NR RRC: Connection Reconfiguration data prepared in step#5.
7. **MeNB** reconfigures the UE via *NR RRC: Connection Reconfiguration* with the NR configuration provided byTarget
8. When UE receives the *RRC: RRC ConnectionReconfiguration* message, it starts the timer T304 to guard the success of PSCell Change. UE starts synchronizing to the downlink of the new PSCell.
9. **MeNB** notifies Target SgNB about successful UE reconfiguration via the *X2AP: SgNB Reconfiguration Complete* message.
10. **MeNB** (LTE4530) notifies about completion of SgNB change via the *X2AP: SgNB Change Confirm*. The message contains X2-U DL data forwarding GTP-U tunnel to be used by source SgNB. UE starts Radom Access Procedure towards Target SgNB
11. The **Source SgNB** suspend the DL & UL traffic, starts buffering potential coming DL packets and communicates to Target the PDCP context (PDCP SN & HFN) via *X2AP: SN Status Transfer* over MeNB
12. At the end **MeNB** triggers UE context release. Source SgNB releases radio and C-plane related resources associated to the UE context. MeNB is informed by MME to start UE contex release (LTE4530)



Technical Details

Intra-Frequency Intra-DU PSCell change for NSA 3x without SRB3(1/2)—5GC001094

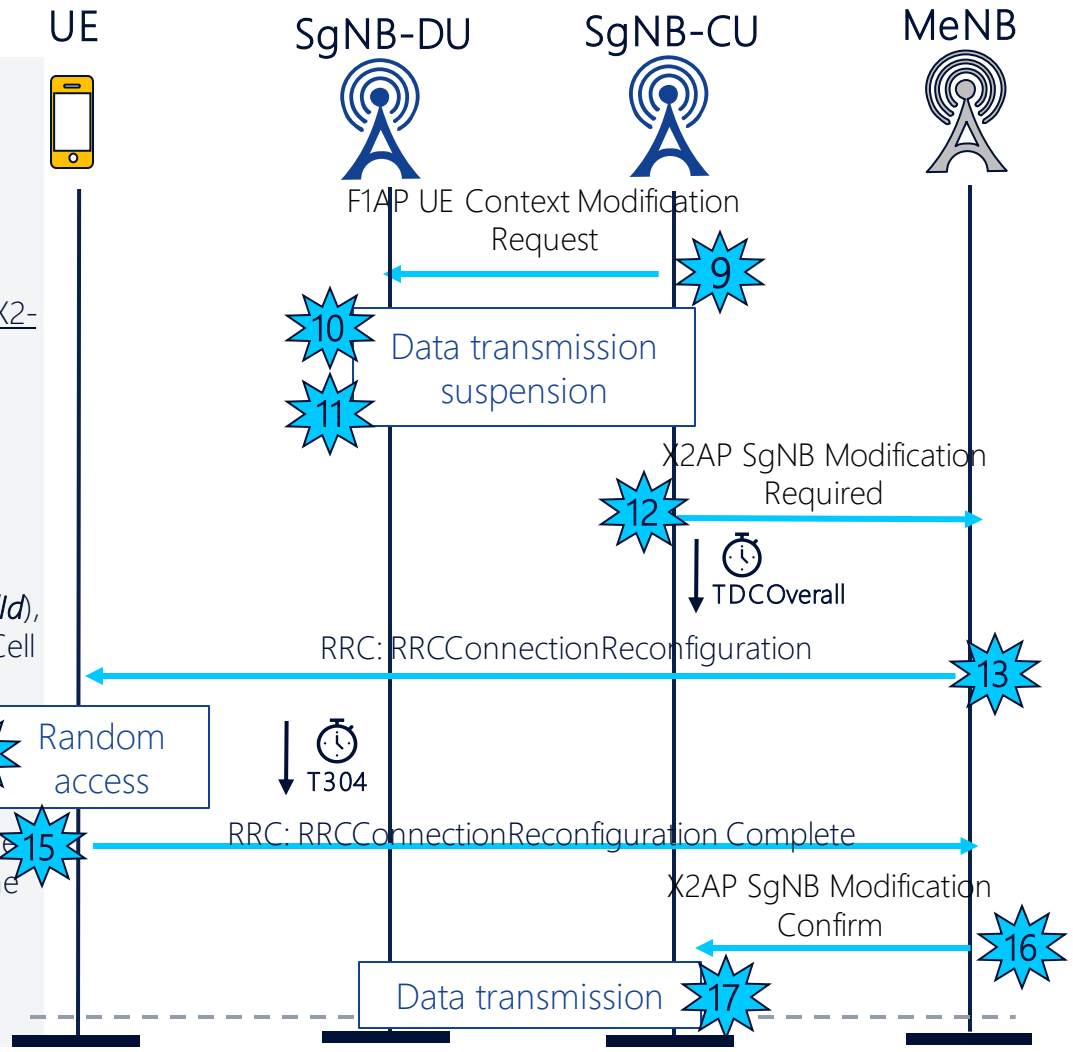
1. gNB-CU configures the event A3/A5 measurement on UE by including *measConfig* IE in the **RRC: RRCReconfiguration** message, which is carried in the **SgNB to MeNB Container** IE of the **X2AP: SgNB Addition Request Acknowledge** message.
2. MeNB transfers the measurement configuration to the UE by sending the **RRC: RRCReconfiguration** message to the UE.
3. UE acknowledges the measurement configuration by sending the **RRC: RRCReconfigurationComplete** message to MeNB.
4. MeNB forwards the RRC message to SgNB in the **MeNB to SgNB Container** IE of the **X2AP: SgNB Reconfiguration Complete** message.
5. When reporting conditions for event A3/A5 are satisfied, UE sends the **RRC: UL Information Transfer** message containing **RRC: MeasurementReport** message to MeNB
6. MeNB forwards the RRC message to SgNB inside the **X2AP: RRC Transfer** message.
7. gNB-CU receives measurement report for event A3/A5 from UE, and selects the strongest reported neighbor as the target cell. If this cell happens to be in the same gNB-DU this triggers 5GC001094 handover handling.
8. gNB-CU performs Admission Control and allocates new UL F1-U TEID



Technical Details

Intra-Frequency Intra-DU PSCell change for NSA 3x (2/2) without SRB3—5GC001904

9. gNB-CU sends **F1AP: UE Context Modification Request** to the gNB-DU to suspend scheduling and to allocate new RLC and MAC resources for the target cell
10. Source cell RLC layer suspends DL data transmission, stops RLC timers, sends DDDS message with FFI=1 to gNB-CU. Target cell RLC allocates new DL F1-U TEID
11. gNB-CU suspends DL data transmission over old F1-U tunnel and X2-U tunnel. After receiving DDDS with FFI=1 over old F1-U tunnel, DL data transmission resumes over X2-U tunnel.
12. gNB-CU triggers the intra-DU PSCell change by sending to MeNB the **X2AP: SgNB Modification Required** message,containing the **RRC: RRCReconfiguration** message. gNB-CU starts the **TDCoverall** timer.
13. MeNB sends the **RRC: RRCConnectionReconfiguration** message to UE.
14. Upon reception of the **RRC: RRCReconfiguration** message (containing *targetPhysCellId*), the UE starts the timer **T304**. UE starts synchronizing to the downlink of the new PSCell and performs Random Access.
15. UE acknowledges the reconfiguration by sending the **RRC: RRCConnectionReconfigurationComplete** message to the MeNB.
16. MeNB sends the **X2AP: SgNB Modification Confirm** message to SgNB. That message contains the **RRC: RRCReconfigurationComplete** message from UE acknowledging the PSCell change. gNB-CU stops the **TDCoverall** timer.
17. After successful handover to target cell gNB-CU switches the data path towards the target cell.

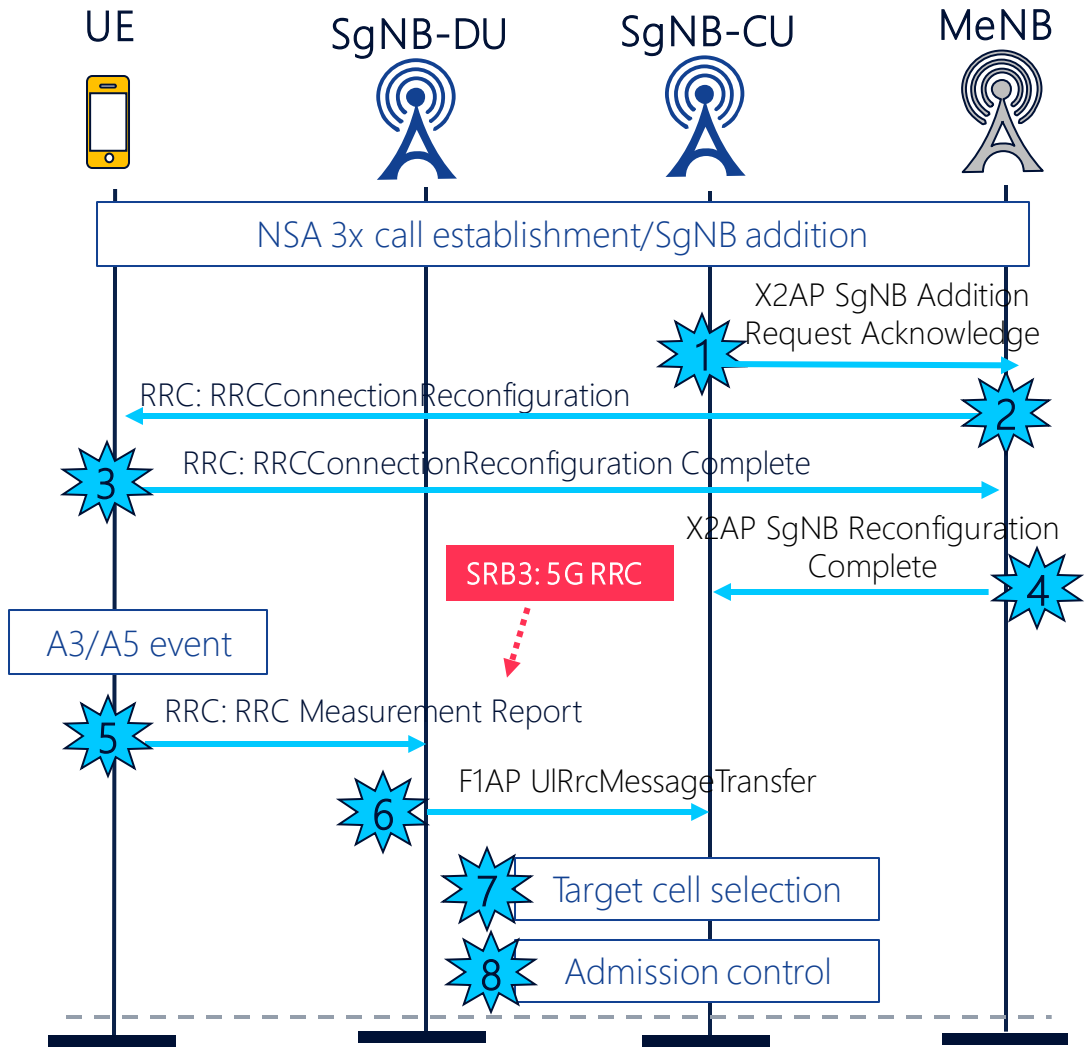


Technical Details

5GC001829 PSCell change with SRB3

Intra-Frequency Intra-DU PSCell change for NSA 3x with SRB3 (1/2)

1. gNB-CU configures the event A3/A5 measurement on UE by including *measConfig* IE in the **RRC: RRCReconfiguration** message, which is carried in the **SgNB to MeNB Container** IE of the **X2AP: SgNB Addition Request Acknowledge** message.
2. MeNB transfers the measurement configuration to the UE by sending the **RRC: RRCReconfiguration** message to the UE.
3. UE acknowledges the measurement configuration by sending the **RRC: RRCReconfigurationComplete** message to MeNB.
4. MeNB forwards the RRC message to SgNB in the **MeNB to SgNB Container** IE of the **X2AP: SgNB Reconfiguration Complete** message.
5. When event A3/A5 has been triggered on UE, UE sends the **RRC: MeasurementReport** message to gNB-DU.
6. gNB-DU forwards the message to gNB-CU in a **F1AP: UlRrcMessageTransfer** message.
7. gNB-CU receives measurement report for event A3/A5 from UE, and selects the strongest reported neighbor as the target cell. If this cell happens to be in the same gNB-DU this triggers 5GC001094 handover handling.
8. gNB-CU performs Admission control and allocates new UL F1-U TEID.

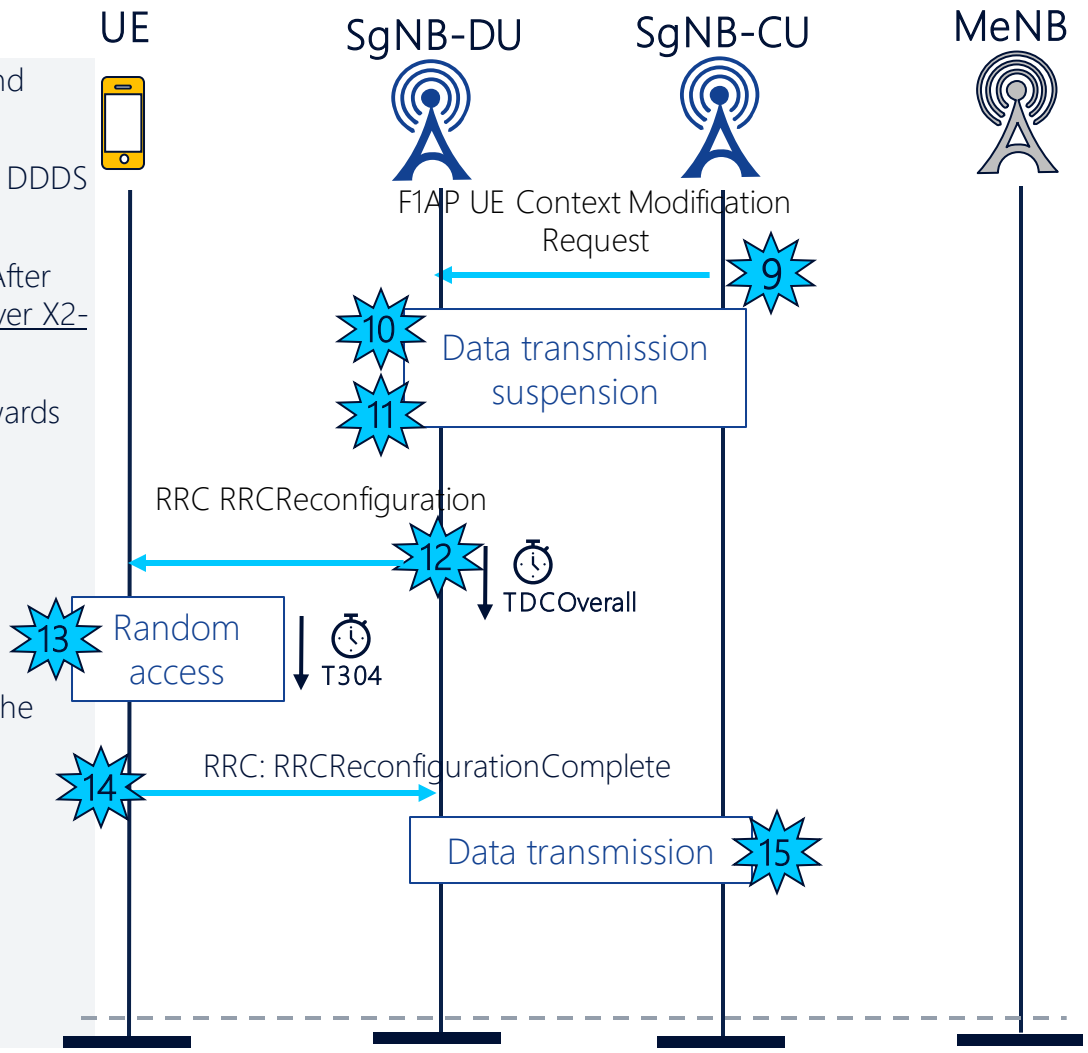


Technical Details

5GC001829 PSCell change with SRB3

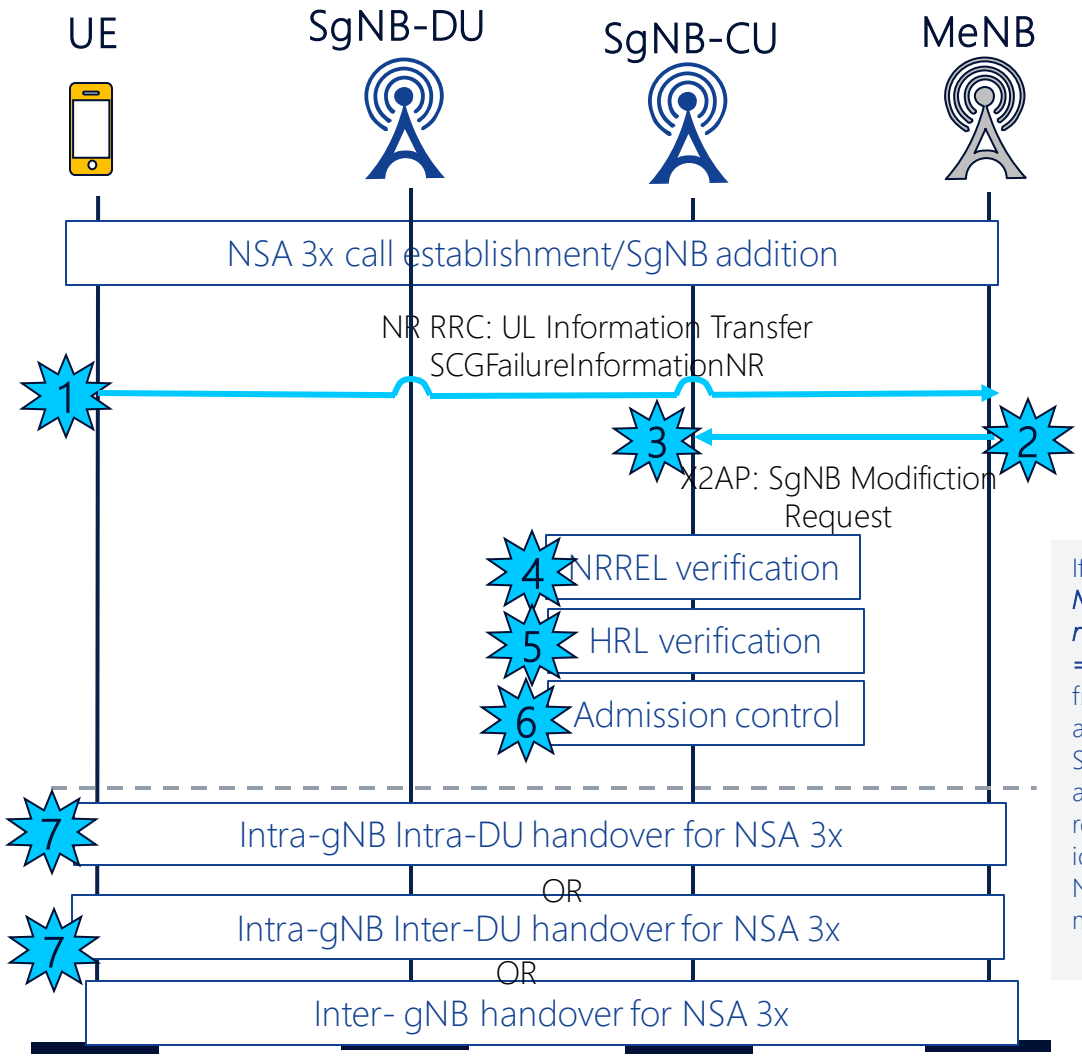
Intra-Frequency Intra-DU PSCell change for NSA 3x with SRB3 (2/2)

9. gNB-CU sends F1AP: UE Context Modification Request to the gNB-DU to suspend scheduling and to allocate new RLC and MAC resources for the target cell
10. Source cell RLC layer suspends DL data transmission, stops RLC timers and sends DDDS message with FFI=1 to gNB-CU. Target cell RLC allocates new DL F1-U TEID
11. gNB-CU suspends DL data transmission over old F1-U tunnel and X2-U tunnel. After receiving DDDS with FFI=1 over old F1-U tunnel, DL data transmission resumes over X2-U tunnel
12. gNB-CU triggers the network based intra-frequency intra-DU PSCell change towards the target cell by sending RRCReconfiguration to the UE via SRB3 with *reconfigurationWithSync* IE to command the UE to move to the target cell. Target physical cell id (*targetPhysCellId*) is included to indicate the new PCell
13. UE does contention based random access to the target cell
14. UE sends RRCReconfigurationComplete to the target cell
15. After successful handover to target cell gNB-CU switches the data path towards the target cell.



Technical Details
SCG Failure for NSA 3x

1. The UE sends to MeNB an LTE **RRC: SCGFailureInformationNR** message, containing measResultSCG-r15
2. MeNB sends to gNB-CU **X2AP Modification Request** message which contains the *SCGFailureInformation*
3. gNB-CU identifies if there are any valid NR cells (ARFCN match)reported in a list of RSRP measurement results.
4. gNB-CU verifies which of the measured cells are configured as NRREL objects for the serving cell
5. gNB-CU selects the strongest reported cell having PLMN that is allowed in the Handover Restriction List.
6. gNB-CU performs the Admission Control.
7. gNB-CU identifies a gNB/gNB-DU that the cell selected in Admission Control belongs to:
    1. If it is the same DU as that of the serving cell, the Intra-DU PSCell change procedure is initiated (5GC001094)
    2. If it is a different DU, the Inter-DU PSCell change procedure is initiated (5GC000572)
    3. If it is a different gNB, the Inter-gNB PSCell change procedure is initiated (5GC000573)



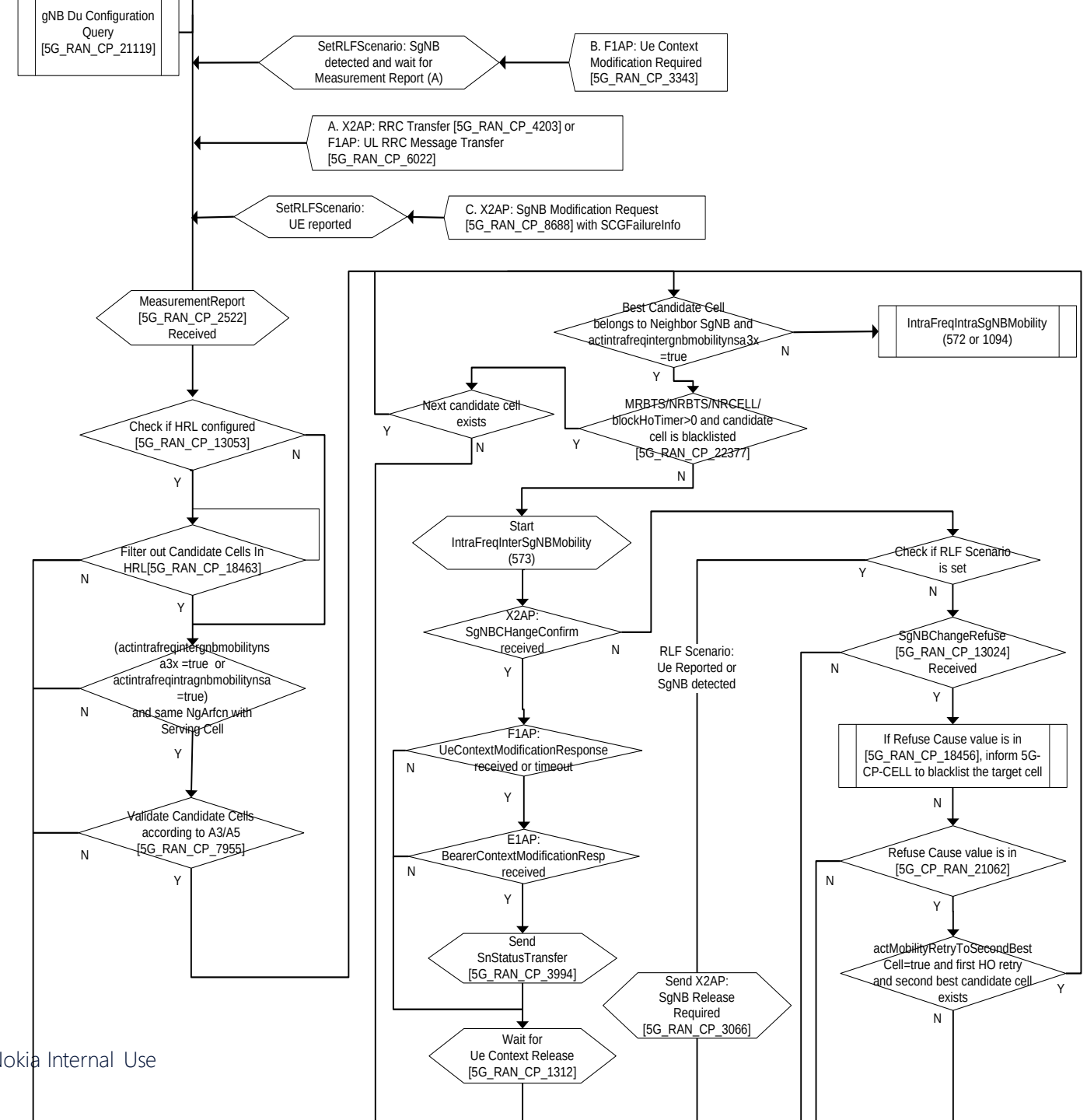
If ***MRBTS/NRBTS/actIntraFreqIntraGnbMobilityNSA = false*** meaning intra-frequency intra-DU and inter-DU intra SgNB mobilities are not allowed, gNB-CU removes the cell(s) identified as the local NR cell(s) from the measurement report.

Technical Details
SCG failure handling for NSA 3x

- When 5G-CP-UE receives X2AP: SgNB Modification Request from MeNB containing *scgFailureInfo,* 5G-CP-UE shall check if it has received scgFailureInfo greater than MRBTS/NRBTS/nrOfScgFailures number of times in MRBTS/NRBTS/duratScgFailures time. If so, 5G-CP-UE shall initiate SN initiated SgNB Release as per [5G_RAN_CP_11879] with cause "Radio Connection with UE Lost".

- Else, PSCell change is tiriggered if the reported RSRP resultSSB-Cell.rsrp shall be >= MRBTS/NRBTS/NRCELL.rlfPsccTrigThresholdRsrp. If none of the reported RSRP resultSSB-Cell.rsrp >= MRBTS/NRBTS/NRCELL.rlfPsccTrigThresholdRsrp, no action is taken.

Technical Details
Intra-Freq HO flow chart



Technical Details
HO Funcation—CPUE(1)

- 5G-CP-UE shall configure the event A3/A5 based measurement on UE(initial Measurement Configuration)
- 5G-CP-UE shall build the RRCReconfiguration message(Handover Command) for PSCell change

  - CellGroupConfig, which shall contain the SpCellConfig IE and the SCellConfig IE

  - SpCellConfig with reconfigurationWithSync shall contain the following IEs, see 5G_RAN_CP_1318:
    - t304: shall be set according to MRBTS/NRBTS/NRCELL/t304
    - C-RNTI: shall be set according to C-RNTI received from target DU
  - spCellConfigCommon
  - SCellConfig shall contain the SCells to be added in DU
  - spCellConfigCommon shall contain the following IEs, see 5G_RAN_CP_1318:
    - physCellId: shall be set according to selected target cell (5G_RAN_CP_4033)
    - RACH-ConfigCommon: shall contain parameters for CBRA procedure
  - RadioBearerConfig shall contain:
    - the recoverPDCP IE set as TRUE
    - the reestablishPDCP IE set as FALSE

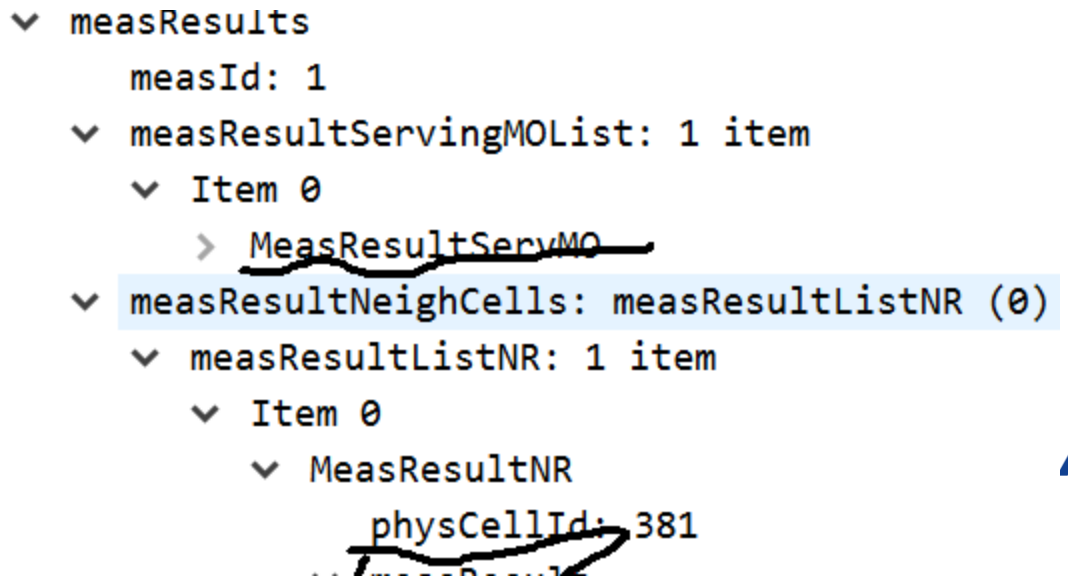
  -downlinkConfigCommon in the servingCellConfigCommon shall contain the initialDownlinkBWP, which shall be the same as the target cell configuration.
  - measConfig the measurement configuration for the target cel

Technical Details
HO Funcation—CPUE(2)

- 5G-CP-UE shall determine which cells to include to CellsToAddModList if there are more than 32 cells which have at least one of its cellIndividualOffset as different from 0dB
  - First criteria is to start with cells having the highest absolute value of cellIndividualOffset
  - and the secondary criteria is to use the cells with the lowest PCIs .

```
CellsToAddModList ::= SEQUENCE (SIZE (1..maxNrofCellMeas=32)) OF CellsToAddMod
CellsToAddMod ::= SEQUENCE {
        physCellId PhysCellId,
        cellIndividualOffset Q-OffsetRangeList}
```

- 5G-CP-UE shall verify the candidated cells according to different mode configured(RSRPCombined/RSRQcombine)



Technical Details
HO Funcation—CPUE(3)

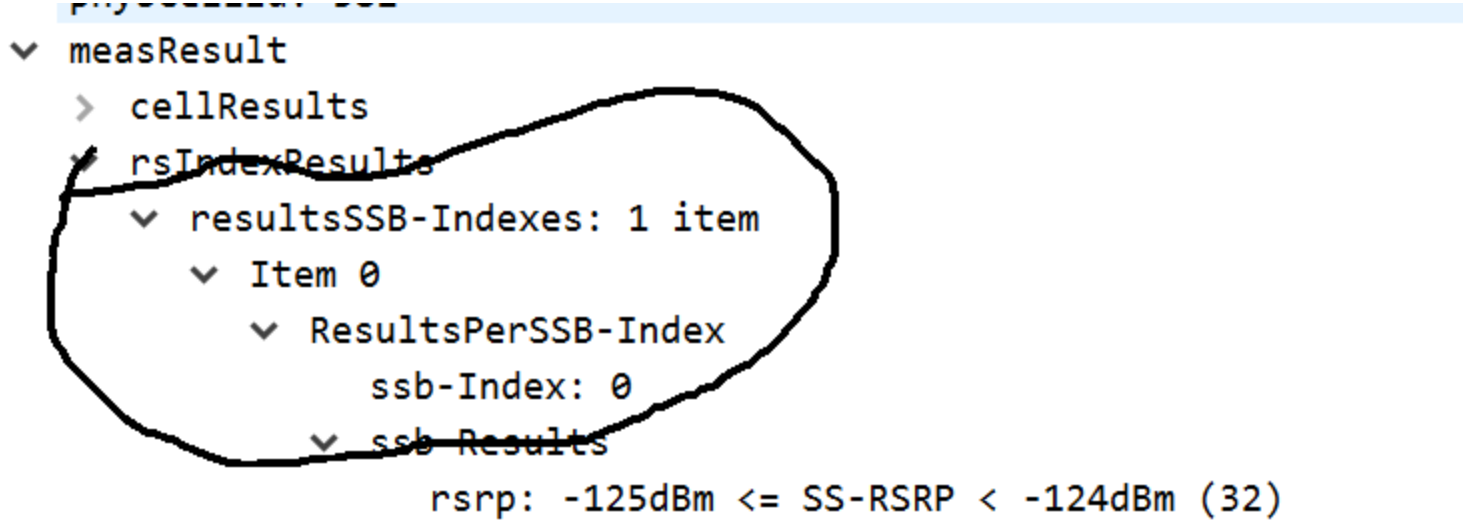
- 5G-CP-UE of Source SgNB shall set the Target SgNB ID

Global en-gNB ID			Target SgNB identity	5GC000573-U
> PLMN Identity	M	OCTET STRING (3)	- digits 0 to 9, encoded 0000 to 1001, - 1111 used as filler digit, two digits per octet, - bits 4 to 1 of octet n encoding digit 2n-1 - bits 8 to 5 of octet n encoding digit 2n -The PLMN identity consists of 3 digits from MCC followed by either -a filler digit plus 2 digits from MNC (in case of 2 digit MNC) or -3 digits from MNC (in case of a 3 digit MNC). MCC is read from MRBTS/NRBTS/NRCELL/NRREL/mcc MNC is read from MRBTS/NRBTS/NRCELL/NRREL/mnc	5GC000573-U
> Choice *en-gNB ID*	M			5GC000573-U
>> *en-gNB ID*				
>>> en-gNB ID	M	BIT STRING (SIZE (22..32))	the gNB ID from the NR Cell Identity selected by the source SgNB as candidate target NRCell as described by [5G_RAN_CP_13298]	5GC000573-U

<managedObject class="com.nokia.srbts.nrbts:NRREL" distName="MRBTS-642/NRBTS-1/NRCELL-1/NRREL-1" version="NRBTS5G19A_1904_201" operation="create"> 0dB 0dB 0 1687 22 16382 633356 381 <list name="gnbPlmn"> <item> 450 5 2 </item> </list>

Technical Details
HO Funcation—CPUE(4)

- 5G-CP-UE shall perform Handover preparations in gNB for CFRA
  - In case of Handover, 5G-CP-UE shall trigger the UE context setup (inter-DU or inter-gNB HO) or modification (intra-DU HO) on the gNB-DU by sending the F1AP: UE Context Setup Request or F1AP: UE Context Modification Request message, CU to DU RRC Information IE shall contain the candidateCellInfoListSN IE in the RRC: CG-ConfigInfo IE. The candidateCellInfoListSN IE contains the CandidateRS-IndexInfoListSSB IE which includes the CandidateRS-IndexInfoSSB IE. That IE contains the SSB and the related measResultSSB. 5G-CP-RT in gNB-DU shall use that information to determine on which SSB to allocate a preamble.
  - When 5G-CP-UE receives the F1AP: UE Context Setup or F1AP: UE Context Modification Response message, included is the DU to CU RRC Information IE, which contains the CellGroupConfig IE. That IE contains the RACH-ConfigDedicated IE, which includes the allocated common preamble for all beam indexes. That IE shall be sent to UE during PSCell change.

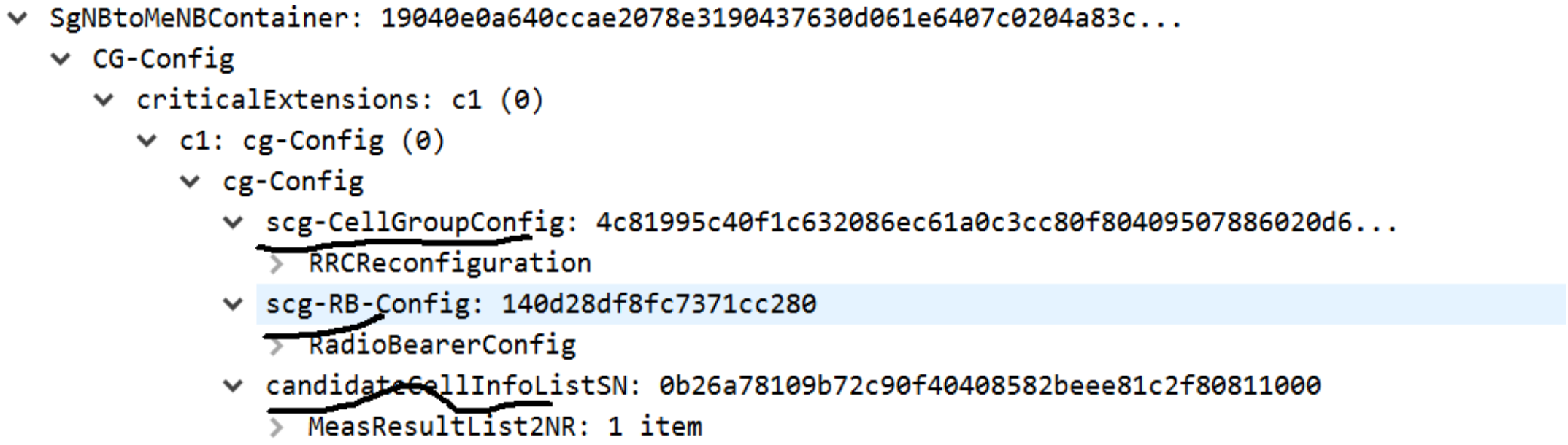


Technical Details
HO Funcation—CPUE(5)

- 5G-CP-UE shall stop/resume data transmission over DU
  - E1 Bearer Context Modification procedure
    - For each DRB, "DRB To Modify Item" is filled will Cell Group To Modify -> DL TX Stop set to Stop/resume, Cell Group ID = 1 (SCG) and RAT Type = NR
  - F1 UE Context Modification Procedure(TransmissionActionIndicator)
  - Note :Resume can also be trigerred in 5G_L2_HI : DDDS received via F1-U after successful RACH by the UE at the target DU
- 5G-CP-UE of Source SgNB shall provide the source CG configuration to Target SgNB
  - scg-CellGroupConfig with RRC container *RRCReconfiguration*
    - It contains the current Physical, MAC, RLC and RRC measurement configurations; These related parameters can be get from the context associated with the UE; secondaryCellGroup is stored into the UE context when received F1AP UE Context Setup Response([5G_RAN_CP_4524]); measConfig is stored and maintained in UE context by 5G-CP-UE
  - scg-RB-Config with RRC container *RadioBearerConfig*
    - It contains the current list of radio bearers with PDCP configuration; PDCP configuration can be found in bearer container stored in associated UE context. 5G-CP-UE shall set srb3 configuration in current list of radio bearers if Srb3 has been

Technical Details
HO Funcation—CPUE(6)

- 5G-CP-UE of Source SgNB shall provide the source CG configuration to Target SgNB
  - selectedBandCombinationNR when the UE is configured with carrier aggregation.



- 5G-CP-UE of Source SgNB shall provide data forwarding information
  - DL Forwarding GTP Tunnel EndPoint attached to each DRB is present in the X2AP: SgNB Change Confirm message. it shall be extracted and provided to L2-NRT via 5G-CP-NRT in the
  - *E-UTRAN.DRB To Modify Item.Data Forwarding Information Response.DL Data Forwarding* IE

Technical Details
HO Funcation—CPUE(7)

- 5G-CP-UE shall support Delta UE configuration optimization
  - 5G-CP-UE of target shall compare the new UE configuration to be provided to the UE with the current UE configuration received from source: the comparaison is used to optimize the delta configuration to be sent to the UE by not setting optional IE which are not needed: optional RRC IE with tag M (“Maintained” as defined by 3GPP TS 38.331 section 6.1.2) is candidate.
  - MRBTS/NRBTS/ActUeDeltaConfigOptimize NIDD parameter/ rdCuUeDeltaConfigOptimize is set to True
  - scg-RB-Config and sourceConfigSCG IEs are present in CG-ConfigInfo RRC container received in X2AP: gNB Addition Request message.

Need M	Maintain Used for (configuration) fields that are stored by the UE i.e. not one-shot. Upon receiving a message with the field absent, the UE maintains the current value.
Need N	No action (one-shot configuration that is not maintained) Used for (configuration) fields that are not stored and whose presence causes a one-time action by the UE. Upon receiving message with the field absent, the UE takes no action.
Need R	Release Used for (configuration) fields that are stored by the UE i.e. not one-shot. Upon receiving a message with the field absent, the UE releases the current value.

- srb-ToAddModList.pdcp-Config.moreThanOneRLC
- drb-ToAddModList.pdcp-Config.drb
- drb-ToAddModList.pdcp-Config.moreThanOneRLC

- measConfig.s-MeasureConfig
- measConfig.quantityConfig
- measConfig.measGapConfig
- measConfig.measGapSharingConfig

Technical Details
HO Funcation—CPUE(8)

- 5G-CP-UE shall support Delta UE configuration optimization
  - scg-RB-Config : the scg-RB-Config.radioBearerConfig in the CG-Config IE:
    - srb-ToAddModList.pdcp-Config.moreThanOneRLC
    - drb-ToAddModList.pdcp-Config.drb
    - drb-ToAddModList.pdcp-Config.moreThanOneRLC

  - scg-CellGroupConfig in the CG-Config:
    - measConfig.s-MeasureConfig
    - measConfig.quantityConfig
    - measConfig.measGapConfig
    - measConfig.measGapSharingConfig

  -

Technical Details
HO Funcation—CPCL

- 5G-CP-CELL shall maintain Availability status Neighbour cells
  - 5G-CP-CELL shall maintain the "Availability" status of Neighbour cells which indicate whether a Handover can be initiated for a given neighbour cell. 5G-CP-CELL shall maintain this in the SDL.
  - When 5G-CP-CELL receives CpCell_CellAvlbHo (5G_RAN_CP_19891) from 5G-CP-UE, 5G-CP-CELL shall mark that NRREL cell as "Unavailable" (Note that 5G-CP-CELL shall also mark a NRREL Cell as "Unavailable" if Admission control fails for that target cell.) for a period of time configured by the NIDD parameter MRBTS/NRBTS/NRCELL/blockHoTimer, and during this period this unavailable cell should not be selected as target cell for HO.
- Status check of the Availability status of the neighbor cell when selecting the cell for inter-gNB HO
-

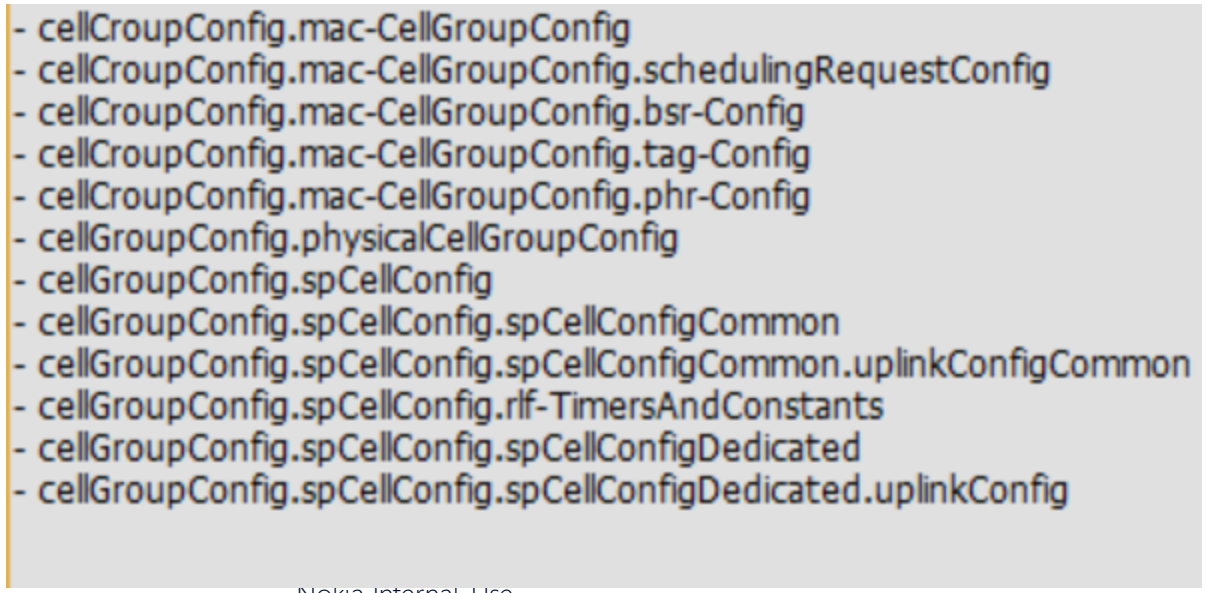
Technical Details
HO Funcation—CPRT(1)

- 5G-CP-RT shall support PSCell change preparation on target DU and Source DU
  - Identify HO: , if CU to DU RRC Information IE contains the *HandoverPreparationInformation* IE in the F1AP: UE Context Modification Request message or F1AP: UE Context Setup Request message
- 5G-CP-RT shall support preamble allocation during Handover to target Cell
  - 5G-CP-RT shall handle the pool for the CFRA: CFRA = [MRBTS/NRBTS/NRCELL/cbraPreamblesPerSsb.. MRBTS/NRBTS/NRCELL/ totalNumberOfRAPreambles-1
  - *HandoverPreparationInformation* IE ->candidateCellInfoListMN IE.->CandidateRS-IndexInfoListSSB IE
  - 5G-CP-RT shall ensure that same ra-PreambleIndex is not assigned to multiple UEs against the same ssb-Index (beam). i.e. for each beam reported by UE, the first unallocated ra-PreambleIndex is allocated to the UE for CFRA
  - When receiving the PsUser_RandomAccessInd message from 5G-L2-PS, 5G-CP-RT shall release the preamble allocated for UE based on the received ueDuId.
- Following table explains the sample ra-PreambleIndex assignment for 4 UEs

	ssb-index=1	ssb-index=2	ssb-index=3	ssb-index=4	UE
ra-PreambleIndex	32	32	32	32	UE1 (reported SSBs 1,2,3 and 4)
ra-PreambleIndex	-	-	33	33	UE2 (reported SSBs 3 and 4)
ra-PreambleIndex	33	33	34	-	UE3 (reported SSBs 1, 2 and 3)
ra-PreambleIndex	-	34	35	34	UE4 (reported SSBs 2, 3 and 4)

Technical Details
HO Funcation—CPRT(2)

- 5G-CP-RT shall support gNB-DU configuration query
  - Upon receipt from gNB-CU of a F1AP: UE Context Modify Request with GNB-DU Configuration Query IE set, 5G-CP-RT shall provide the complete UE configuration (i.e. L1 and L2 parameters) in the CellGroupConfig RRC container piggybacked in the DU To CU RRC Information IE of the F1AP: UE Context Modify Response.
- 5G-CP-RT shall support Delta UE configuration optimization
  - 5G-CP-RT of target shall compare the new UE configuration to be provided to the UE with the current UE configuration received from source (sourceConfigSCG).
  - 5G-CP-RT of target shall set each following RRC IE of the cellGroupConfig RRC container in the DU to CU RRC information F1AP IE of the F1AP: F1AP UE context Setup Response message [5G_RAN_CP_856] when the IE value is different than those value received in the CG-ConfigInfo.sourceConfigSCG



Failure case

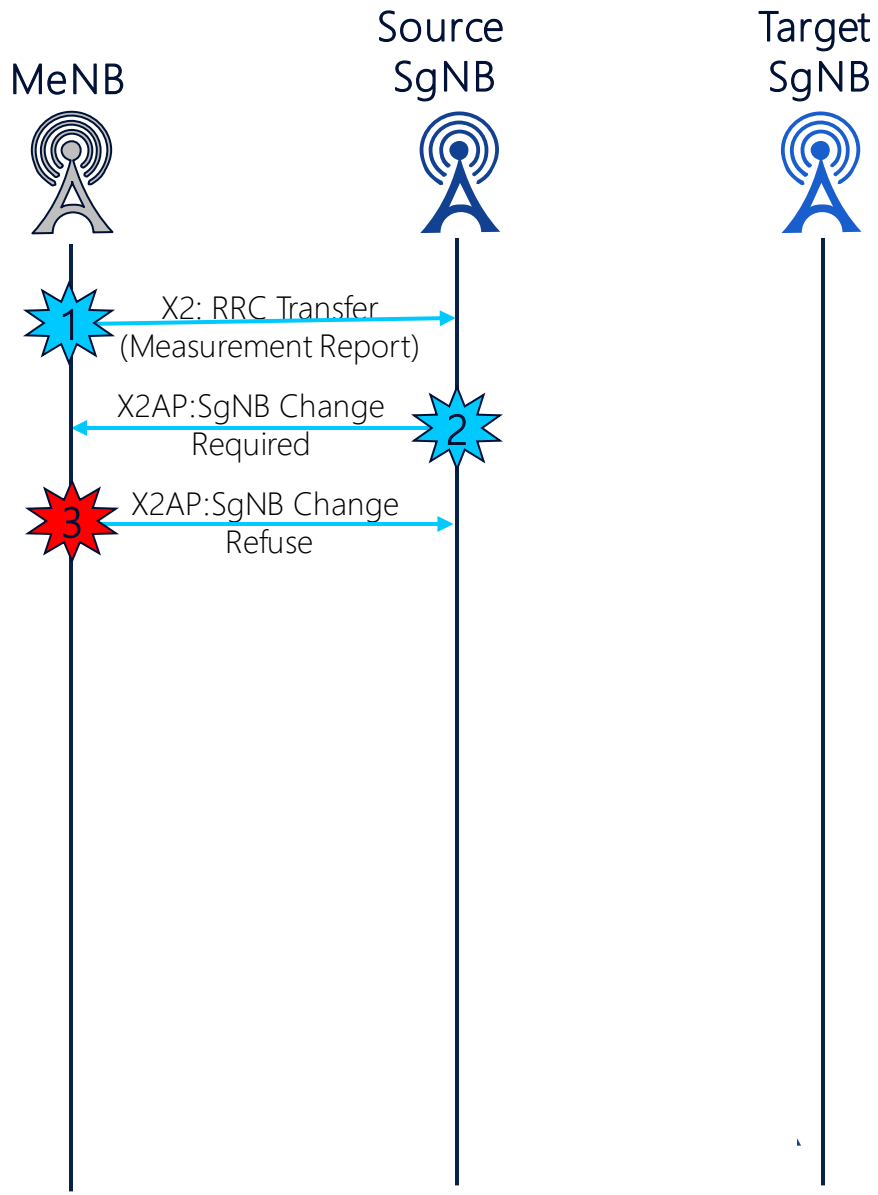
Technical Details

Unsucessfull Handover scenario

Reason: Change of SgNB cell refused by MeNB.

1. Source SgNB (gNB-CU-CP) recevies measurement report via *X2AP: RRC Transfer* message
2. Source SgNB (gNB-CU-CP) triggers *X2AP: SgNB Change Required* towards MeNB containing mainly the X2AP UE ID, the NR radio configuration, the ID of candidate target SgNB, the list of candidated target cells and the cause
3. MeNB rejects the change of 5G cell. The value cause is the subject of LTE4530

POSTCONDITION: NSA call remians established in Source SgNB. The next HO attempt might be for second best 5G cell (if available) or later upon receipt on a next Measurement report



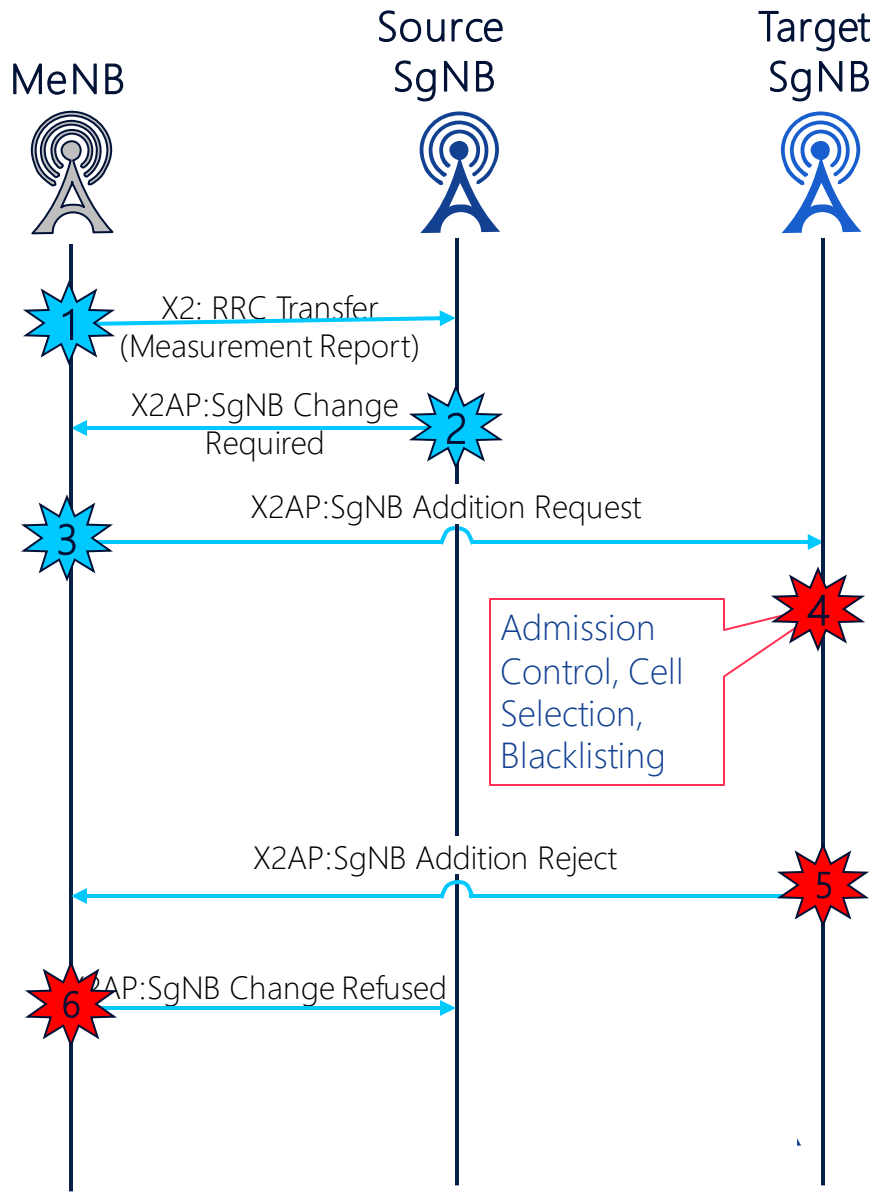
Technical Details

Unsucessfull Handover scenario

Reason: Change of SgNB cell refused by Admission Control of Target SgNB.

1. Source SgNB (gNB-CU-CP) recevies measurement report via *X2AP: RRC Transfer* message
2. Source SgNB (gNB-CU-CP) triggers *X2AP: SgNB Change Required* towards MeNB containing mainly the X2AP UE ID, the NR radio configuration, the ID of candidate target SgNB, the list of candidated target cells and the cause
3. The MeNB decodes the msg#3, identifies and prepares the target SgNB cell by sending *X2AP: SgNB Addition Request* towards Target SgNB-CU-CP
4. Admission control of Target SgNB refuesed the change of 5G cell. Target
5. SgNB sends *X2AP:SgNB Addition Reject* message to MeNB with cause „no available resource".
6. MeNB idicates about that Source SgNB with *X2AP: SgNB Change Refused*

POSTCONDITION: NSA call remains established in Source SgNB. The next HO attempt might be for second best 5G cell (if available) or later upon receipt on a next measurement report



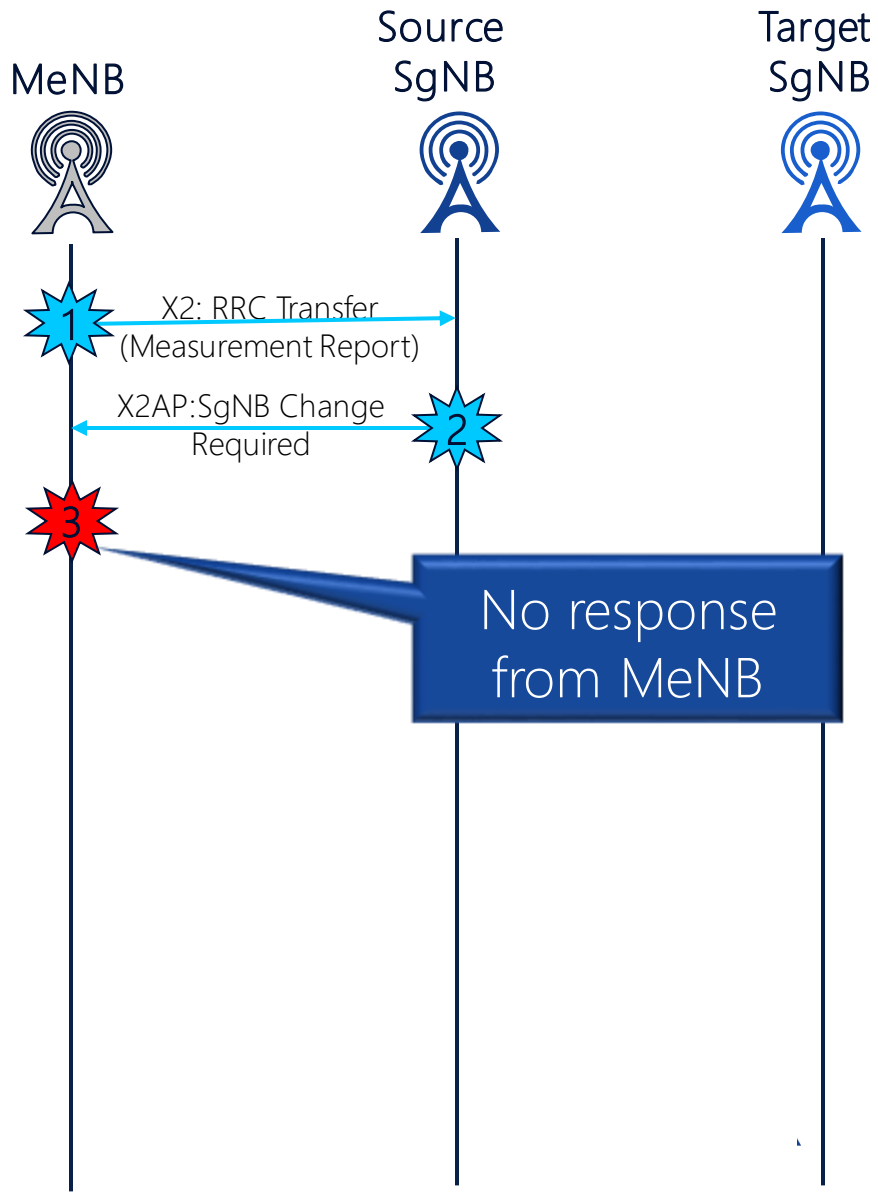
Technical Details

Unsucessfull Handover scenario

Reason: Change of SgNB failed because lack of response from MeNB.

1. Source SgNB (gNB-CU-CP) recevies measurement report via *X2AP: RRC Transfer* message
2. Source SgNB (gNB-CU-CP) triggers *X2AP: SgNB Change Required* towards MeNB containing mainly the X2AP UE ID, the NR radio configuration, the ID of candidate target SgNB, the list of candidated target cells and the cause
3. No response from MeNB. After the timer expiry SgNB didn't receive the change confirmation or refuse message from MeNB. SgNB considers HO attempt as a failed

POSTCONDITION: The NSA call remains established in source SgNB and is candidate to a next trigger like RRC measurement report, RLF detection or user inactivity detection



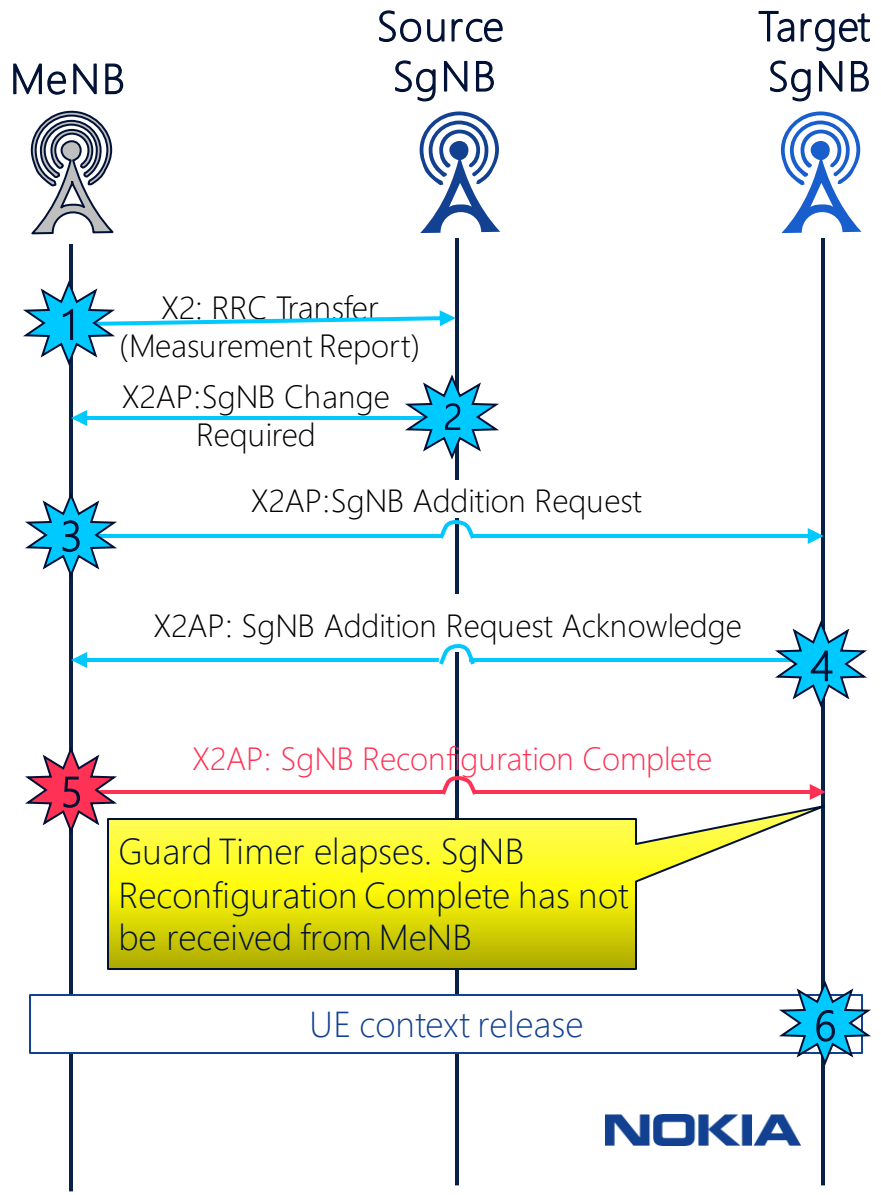
Technical Details

Unsucessfull Handover scenario

Reason: Target SgNB doesn't receive the X2 SgNB Reconfiguration Complete from MeNB.

1. Source SgNB (gNB-CU-CP) recevies measurement report via *X2AP: RRC Transfer* message
2. Source SgNB (gNB-CU-CP) triggers *X2AP: SgNB Change Required* towards MeNB containing mainly the X2AP UE ID, the NR radio configuration, the ID of candidate target SgNB, the list of candidated target cells and the cause
3. The MeNB decodes the msg#3, identifies and prepares the target SgNB cell by sending *X2AP: SgNB Addition Request* towards target SgNB-CU
4. Target SgNB acknowledges the SgNB Addition procedure to MeNB via *X2AP: SgNB Addition acknowledge*. The message includes also RRC: Reconfiguration message
5. Target SgNB doesn't receive the SgNB Reconfiugration Complete message from MeNB .
6. As defence mechanism target SgNB triggers a SgNB Release (SN initiated) procedure. Source SgNB receives a *X2AP: UE Context Reaase* message from MeNB to release the UE context and assicated resources allocated for the source PSCell and SCells..

POSTCONDITIOS: The NSA call has been released.



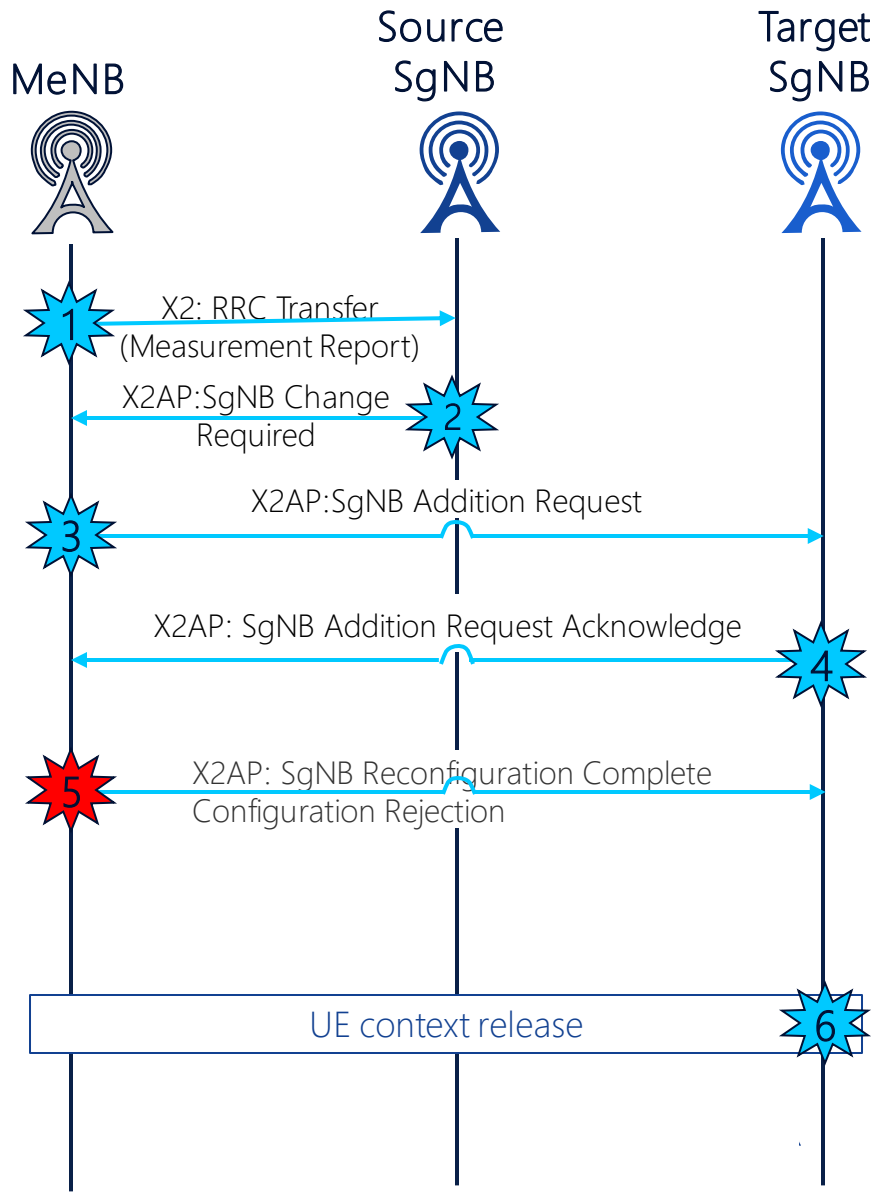
Technical Details

Unsucessfull Handover scenario

Reason: Target SgNB receives a SgNB Reconfiguration Compete with configuration rejection from MeNB

1. Source SgNB (gNB-CU-CP) recevies measurement report via *X2AP: RRC Transfer* message
2. Source SgNB (gNB-CU-CP) triggers *X2AP: SgNB Change Required* towards MeNB containing mainly the X2AP UE ID, the NR radio configuration, the ID of candidate target SgNB, the list of candidated target cells and the cause
3. The MeNB decodes the msg#3, identifies and prepares the target SgNB cell by sending *X2AP: SgNB Addition Request* towards target SgNB-CU
4. Target SgNB acknowledges the SgNB Addition procedure to MeNB via *X2AP: SgNB Addition acknowledge*. The message includes also RRC: Reconfiguration message
5. Target SgNB receives the SgNB Reconfiguration Compete from MeNB with status reconfiguration rejected.
6. As defence mechanism Target SgNB triggers a SgNB Release procedure. Target SgNB sends *X2AP: UE Context Release* message to release the UE context and associated resources allocated for the Source PSCell and SCells.

POSTCONDITION: The NSA call has been released



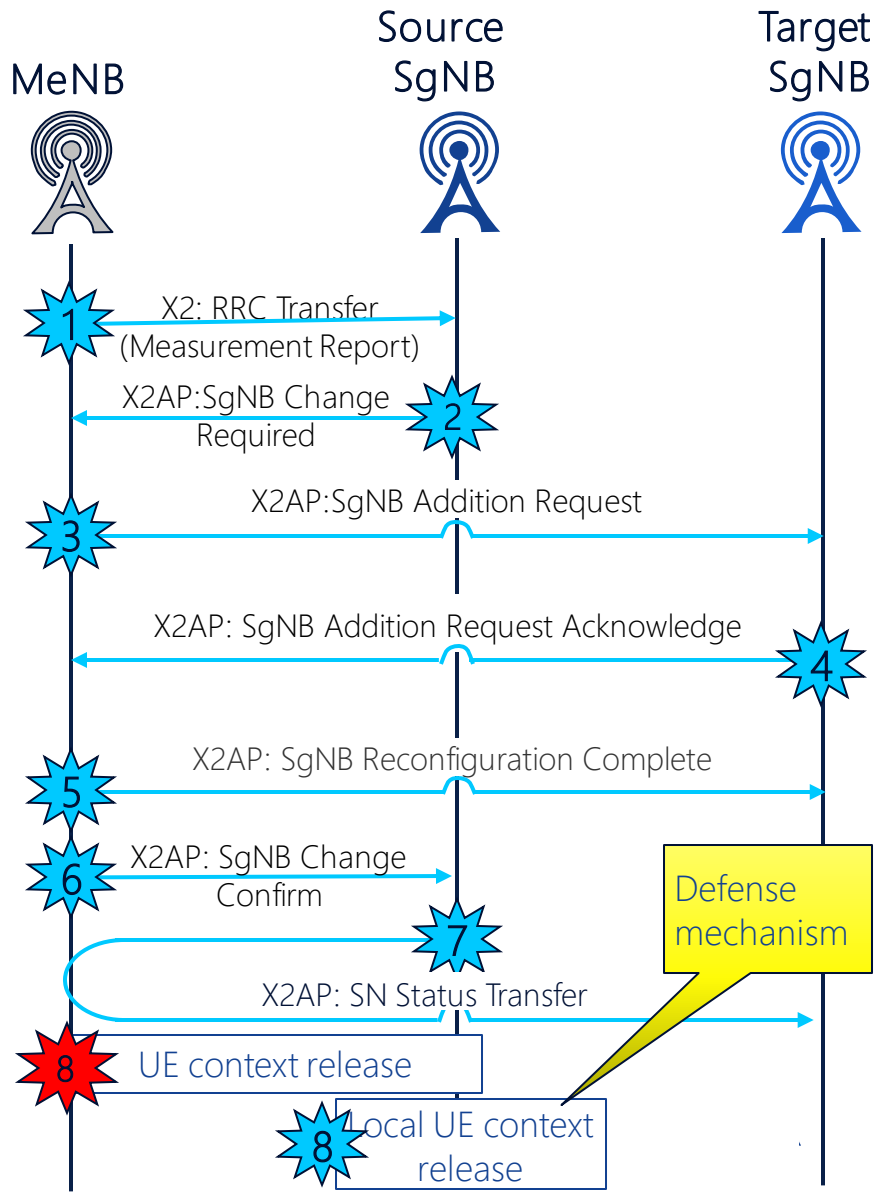
Technical Details

Error handling – UE context release

Reason: Source SgNB didn't receive the UE context release message.

1. Source SgNB (gNB-CU-CP) recevies measurement report via *X2AP: RRC Transfer* message
2. Source SgNB (gNB-CU-CP) triggers *X2AP: SgNB Change Required* towards MeNB containing mainly the X2AP UE ID, the NR radio configuration, the ID of candidate target SgNB, the list of candidated target cells and the cause
3. The MeNB decodes the msg#3, identifies and prepares the target SgNB cell by sending *X2AP: SgNB Addition Request* towards target SgNB-CU
4. Target SgNB acknowledges the SgNB Addition procedure to MeNB via *X2AP: SgNB Addition acknowledge*. The message includes also RRC: Reconfiguration message
5. When MeNB recevies the *RRC: Reconfiguration complete* message from UE then MeNB notifies about that target SgNB via *X2AP: SgNB Reconfiguration Complete*
6. MeNB (LTE4530) notifies Source SgNB about completion of SgNB change via the *X2AP: SgNB Change Confirm*.
7. The Source SgNB communicates to Target the PDCP context (PDCP SN & HFN) via *X2AP: SN Status Transfer* over MeNB
8. MeNB doesn't triggers UE context release.
9. As defense mechanism SgNB release locally the UE context and resources allocated for the source PSCell and SCells.

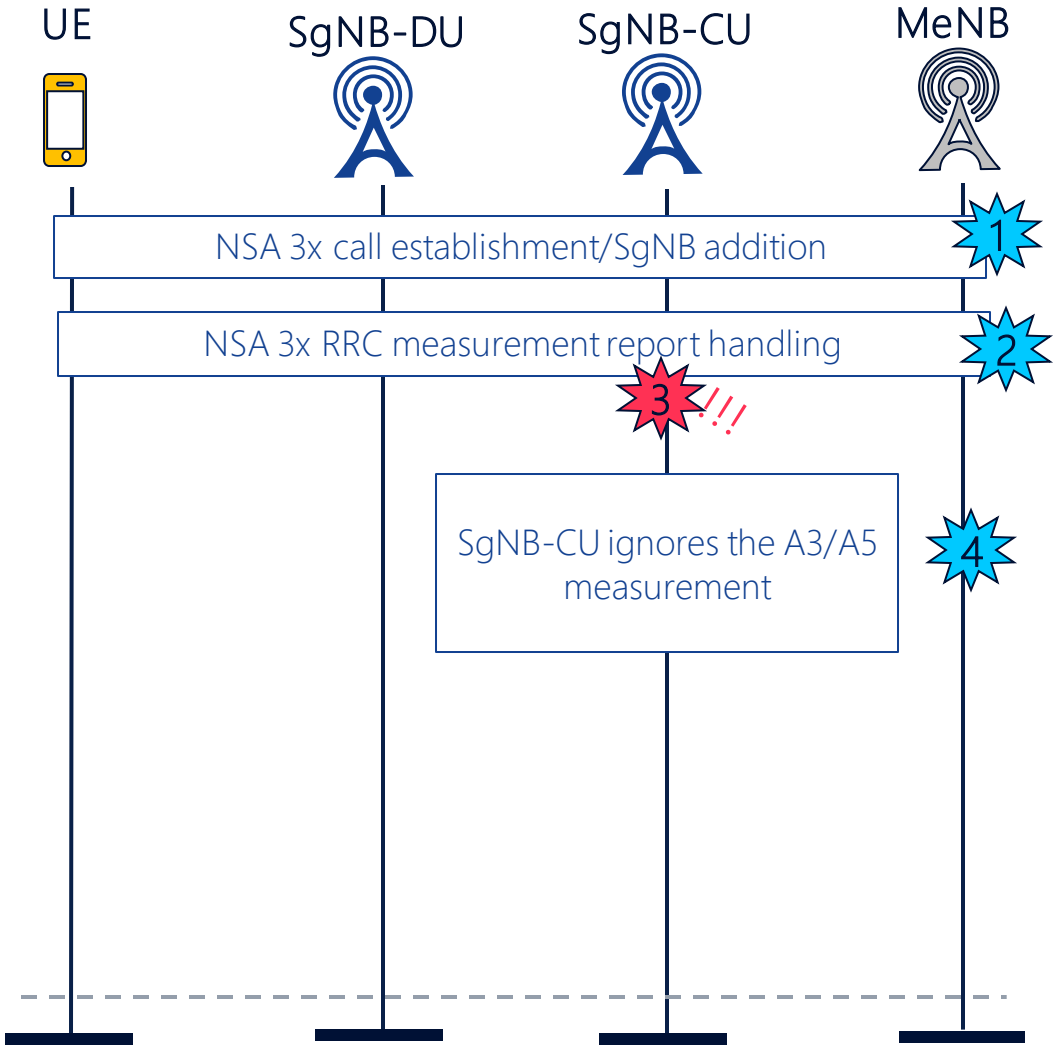
POSTCONDITIO: The NSA call is established in the target SgNB



Technical Details

Unsuccessful PSCell change due to resource failure in target cell

1. SgNB addition procedure is successful
2. NR measurements are configured, measurement report is received and is processed by gNB-CU (report received from UE either via MeNB). gNB-CU identifies the received Measurement Report as A3/A5 Measurement Report based on the measId IE received in the Measurement Report message. If the received Measurement Report is for event A3 or A5, gNB-CU identifies the gNB to which the strongest reported cell belongs to
3. 4. gNB-CU **performs the admission control. No resources found** in target cell.
4. gNB-CU **cancels the PSCell change procedure and ignores this measurement report** from UE. gNB-CU updates counter INTRA_FR_PSCEL_CH_FAI_RES_ALLO.



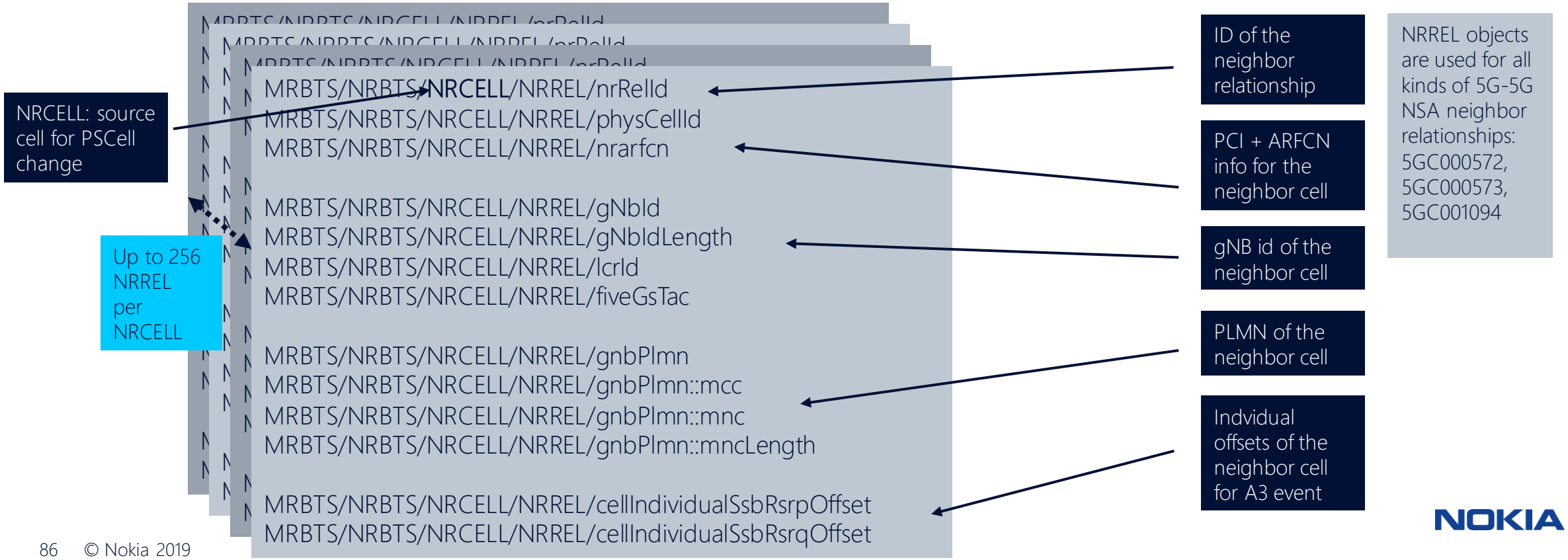
Deployment Aspects

Deployment aspects
NRREL objects for 5G neighbor relations

The Cell List IE sent for the Admission Control will include only cells that are configured as NRREL objects for the serving cell and whose PLMN allowed by Selected PLMN and Handover Restriction List

Neighbor relations between 5G cells are using NRREL object class (MRBTS/NRBTS/NRCELL)

- The neighbor relations from a given 5G cell are possible only for cells for which the NRREL objects are defined in the NRCELL object relevant to the source cell
- Up to 256 NRREL objects can be created per 5G NRCELL object (1 radio cell – can be multiple NRCELLs per DU)



Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/actIntraFreqIntraGnbMobilityNSA	Activate intra-frequency intra-gNB mobility NSA	This parameter activates/deactivates the intra-frequency intra-gNB mobility NSA, which covers both intra-DU and inter-DU case. There's one parameter common for features: 5GC000572 Nw based Intra-Freq Intra-5GNB PSCell change for NSA Opt 3x, 5GC001094 Intra-Frequency Intra-DU en-gNB mobility (NSA option 3x)	0 (false), 1 (true)	0 (false)	link
	MRBTS/NRBTS/NRCELL/a3MeasEnabled	a3 Measurement Configuration Enabled	This parameter indicates the measurement configuration that is enabled on event a3. This can be the RSRP measurement or the RSRQ measurement or both or a combined criteria.	0 = none 1 = rsrp 2 = rsrq 3 = rsrpAndRsrq 4 = rsrpCombined 5 = rsrqCombined	0 (none)	link
	MRBTS/NRBTS/NRCELL/a5MeasEnabled	a5 Measurement Configuration Enabled	This parameter indicates the measurement configuration that is enabled on event a5. This can be the RSRP measurement or the RSRQ measurement or both or a combined criteria.	0 = none 1 = rsrp 2 = rsrq 3 = rsrpAndRsrq 4 = rsrpCombined 5 = rsrqCombined	0 (none)	link

REQUIRES BTS RESTART REQUIRES CELL LOCKING ONLINE MODIFIABLE NOT MODIFIABLE

Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/a3MeasSsbRsrp	a3 Measurement Ssb Rsrp	This parameter gathers all the associated parameters used to characterize the set of a3 measurement for RS type SS/PBCH blocks and measurement quantities RSRP. Type: structure. Structure members: a3HysteresisSsbRsrp | a3OffsetSsbRsrp | a3TimeToTriggerSsbRsrp	-	-	link
	MRBTS/NRBTS/NRCELL/a3MeasSsbRsrp::a3HysteresisSsbRsrp	a3 Hysteresis Ssb Rsrp	This parameter indicates the hysteresis value for RS type SS/PBCH blocks and measurement quantities RSRP to be used in NR measurement report triggering condition on event a3. 3GPP Name: hysteresis	from 0 to 30 step 1	-	link
	MRBTS/NRBTS/NRCELL/a3MeasSsbRsrp::a3OffsetSsbRsrp	a3 Offset Ssb Rsrp	This parameter defines the offset value for RS type SS/PBCH blocks and measurement quantities RSRP to be used in NR measurement report triggering condition on event a3. 3GPP Name: a3-Offset	from -30 to 30 step 1	-	link

REQUIRES BTS RESTART REQUIRES CELL LOCKING ONLINE MODIFIABLE NOT MODIFIABLE

Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/a3MeasSsbRsrp::a3TimeToTriggerSsbRsrp	a3 Time To Trigger Ssb Rsrp	This parameter defines the time during which specific criteria for the event needs to be met in order to trigger a measurement report for RS type SS/PBCH blocks and measurement quantities RSRP to be used in NR measurement report triggering condition on event a3. 3GPP Name timeToTrigger	0 0 ms 1 40 ms 2 64 ms 3 80 ms 4 100 ms 5 128 ms 6 160 ms 7 256 ms 8 320 ms 9 480 ms 10 512 ms 11 640 ms 12 1024 ms 13 1280 ms 14 2560 ms 15 5120 ms	-	link

REQUIRES BTS RESTART REQUIRES CELL LOCKING ONLINE MODIFIABLE NOT MODIFIABLE

Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/a3MeasSsbRsrq	a3 Measurement Ssb Rsrq	This parameter gathers all the associated parameters used to characterize the set of a3 measurement for RS type SS/PBCH blocks and measurement quantities RSRQ. Structure members: a3HysteresisSsbRsrq | a3OffsetSsbRsrq | a3TimeToTriggerSsbRsrq	-	-	link
	MRBTS/NRBTS/NRCELL/a3MeasSsbRsrq::a3HysteresisSsbRsrq	a3 Hysteresis Ssb Rsrq	This parameter indicates the hysteresis value for RS type SS/PBCH blocks and measurement quantities RSRQ to be used in NR measurement report triggering condition on event a3. 3GPP Name: hysteresis	from 0 to 30 step 1	-	link
	MRBTS/NRBTS/NRCELL/a3MeasSsbRsrq::a3OffsetSsbRsrq	a3 Offset Ssb Rsrq	This parameter defines the offset value for RS type SS/PBCH blocks and measurement quantities RSRQ to be used in NR measurement report triggering condition on event a3. 3GPP Name: a3-Offset	from -30 to 30 step 1	-	link

REQUIRES BTS RESTART REQUIRES CELL LOCKING ONLINE MODIFIABLE NOT MODIFIABLE

Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/a3MeasSsbRsrq::a3TimeToTriggerSsbRsrq	a3 Time To Trigger Ssb Rsrq	This parameter defines the time during which specific criteria for the event needs to be met in order to trigger a measurement report for RS type SS/PBCH blocks and measurement quantities RSRQ to be used in NR measurement report triggering condition on event a3. 3GPP Name: timeToTrigger	0 0 ms 1 40 ms 2 64 ms 3 80 ms 4 100 ms 5 128 ms 6 160 ms 7 256 ms 8 320 ms 9 480 ms 10 512 ms 11 640 ms 12 1024 ms 13 1280 ms 14 2560 ms 15 5120 ms	-	link

REQUIRES BTS RESTART REQUIRES CELL LOCKING ONLINE MODIFIABLE NOT MODIFIABLE

Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/a5MeasSsbRsrp	a5 Measurement Ssb Rsrp	This structure gathers all the associated parameters used to characterize the set of a5 measurement for RS type SS/PBCH blocks and measurement quantities RSRP. Structure memebers: a5HysteresisSsbRsrp | a5Threshold1SsbRsrp | a5Threshold2SsbRsrp | a5TimeToTriggerSsbRsrp	-	-	link
	MRBTS/NRBTS/NRCELL/a5MeasSsbRsrp::a5HysteresisSsbRsrp	a5 Hysteresis Ssb Rsrp	This parameter specifies the hysteresis value for RS type SS/PBCH blocks and measurement quantities RSRP to be used in NR measurement report triggering condition on event a5. 3GPP Name: hysteresis	from 0 to 30 step 1	-	link
	MRBTS/NRBTS/NRCELL/a5MeasSsbRsrp::a5Threshold1SsbRsrp	a5 Threshold1 Ssb Rsrp	This parameter defines the threshold1 value for RS type SS/PBCH blocks and measurement quantities RSRP to be used in NR measurement report triggering condition on event a5. 3GPP Name: a5-Threshold1	from 0 to 127 step 1	-	link
	MRBTS/NRBTS/NRCELL/a5MeasSsbRsrp::a5Threshold2SsbRsrp	a5 Threshold2 Ssb Rsrp	This parameter defines the threshold2 value for RS type SS/PBCH blocks and measurement quantities RSRP to be used in NR measurement report triggering condition on event a5. 3GPP Name: a5-Threshold2	from 0 to 127 step 1	-	link

REQUIRES BTS RESTART REQUIRES CELL LOCKING ONLINE MODIFIABLE NOT MODIFIABLE

Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/a5MeasSsbRsrp::a5TimeToTriggerSsbRsrp	a5 Time To Trigger Ssb Rsrp	This parameter defines the time during which specific criteria for the event needs to be met in order to trigger a measurement report for RS type SS/PBCH blocks and measurement quantities RSRP to be used in NR measurement report triggering condition on event a5. 3GPP Name: timeToTrigger	0 0 ms 1 40 ms 2 64 ms 3 80 ms 4 100 ms 5 128 ms 6 160 ms 7 256 ms 8 320 ms 9 480 ms 10 512 ms 11 640 ms 12 1024 ms 13 1280 ms 14 2560 ms 15 5120 ms	-	link

REQUIRES BTS RESTART REQUIRES CELL LOCKING ONLINE MODIFIABLE NOT MODIFIABLE

Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/a5MeasSsbRsrq	a5 Measurement Ssb Rsrq	This structure gathers all the associated parameters used to characterize the set of a5 measurement for RS type SS/PBCH blocks and measurement quantities RSRQ. Structure members: a5HysteresisSsbRsrq | a5Threshold1SsbRsrq | a5Threshold2SsbRsrq | a5TimeToTriggerSsbRsrq	-	-	link
	MRBTS/NRBTS/NRCELL/a5MeasSsbRsrq::a5HysteresisSsbRsrq	a5 Hysteresis Ssb Rsrq	This parameter specifies the hysteresis value for RS type SS/PBCH blocks and measurement quantities RSRQ to be used in NR measurement report triggering condition on event a5. 3GPP Name: hysteresis	from 0 to 30 step 1	-	link
	MRBTS/NRBTS/NRCELL/a5MeasSsbRsrq::a5Threshold1SsbRsrq	a5 Threshold1 Ssb Rsrq	This parameter defines the threshold1 value for RS type SS/PBCH blocks and measurement quantities RSRQ to be used in NR measurement report triggering condition on event a5. 3GPP Name: a5-Threshold1	from 0 to 127 step 1	-	link
	MRBTS/NRBTS/NRCELL/a5MeasSsbRsrq::a5Threshold2SsbRsrq	a5 Threshold2 Ssb Rsrq	This parameter defines the threshold2 value for RS type SS/PBCH blocks and measurement quantities RSRQ to be used in NR measurement report triggering condition on event a5. 3GPP Name: a5-Threshold2	from 0 to 127 step 1	-	link

REQUIRES BTS RESTART REQUIRES CELL LOCKING ONLINE MODIFIABLE NOT MODIFIABLE

Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/a5MeasSsbRsrq::a5TimeToTriggerSsbRsrq	a5 Time To Trigger Ssb Rsrq	This parameter defines the time during which specific criteria for the event needs to be met in order to trigger a measurement report for RS type SS/PBCH blocks and measurement quantities RSRQ to be used in NR measurement report triggering condition on event a5 3GPP Name: timeToTrigger	0 0 ms 1 40 ms 2 64 ms 3 80 ms 4 100 ms 5 128 ms 6 160 ms 7 256 ms 8 320 ms 9 480 ms 10 512 ms 11 640 ms 12 1024 ms 13 1280 ms 14 2560 ms 15 5120 ms	-	link

REQUIRES BTS RESTART REQUIRES CELL LOCKING ONLINE MODIFIABLE NOT MODIFIABLE

Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/absThreshSsbRsrpConsolidation	Absolute Threshold Ssb Rsrp Consolidation	This parameter defines the absolute RSRP threshold for the consolidation of measurement results per SS/PBCH block(s) from L1 filter(s). 3GPP Name: absThreshSS-BlocksConsolidation	from 0 to 127 step 1	-	link
	MRBTS/NRBTS/NRCELL/absThreshSsbRsrqConsolidation	Absolute Threshold Ssb Rsrq Consolidation	This parameter defines the absolute RSRQ threshold for the consolidation of measurement results per SS/PBCH block(s) from L1 filter(s). 3GPP Name: absThreshSS-BlocksConsolidation	from 0 to 127 step 1	-	link
	MRBTS/NRBTS/actDataDuplicationForMobility	Activate data duplication for mobility	Activate data duplication for mobility This parameter activates/deactivates data duplication for mobility. It defines whether the gNB is allowed to send duplicate PDCP PDU when mobility is ongoing to improve PDCP PDU delivery reliability.	0 (false), 1 (true)	0 (false)	link

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Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/**NRCELL**/cellIndividualSsbRsrpOffset	Cell Individual SSB RSRP Offset	This parameter defines the cell individual SSB RSRP offset applicable to a specific cell 3GPP Name: cellIndividualOffset	0 = -24dB; 2 = -22dB; 4 = -20dB; 6 = -18dB; 8 = -16dB; 10 = -14dB; 12 = -12dB; 14 = -10dB; 16 = -8dB; 18 = -6dB; 19 = -5dB; 20 = -4dB; 21 = -3dB; 22 = -2dB; 23 = -1dB; 24 = 0dB; 25 = 1dB; 26 = 2dB; 27 = 3dB; 28 = 4dB; 29 = 5dB; 30 = 6dB; 32 = 8dB; 34 = 10dB; 38 = 12dB; 40 = 14dB; 42 = 16dB; 44 = 18dB; 48 = 20dB; 50 = 22dB; 54 = 24dB	24 (0dB)	link

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Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/NRREL/cellIndividualSsbRsrpOffset	Cell individual SSB RSRP offset of related neighbor cell	This parameter defines the cell individual SSB RSRP offset applicable to the related neighbor cell. 3GPP Name: cellIndividualOffset	0 = -24dB; 2 = -22dB; 4 = -20dB; 6 = -18dB; 8 = -16dB; 10 = -14dB; 12 = -12dB; 14 = -10dB; 16 = -8dB; 18 = -6dB; 19 = -5dB; 20 = -4dB; 21 = -3dB; 22 = -2dB; 23 = -1dB; 24 = 0dB; 25 = 1dB; 26 = 2dB; 27 = 3dB; 28 = 4dB; 29 = 5dB; 30 = 6dB; 32 = 8dB; 34 = 10dB; 38 = 12dB; 40 = 14dB; 42 = 16dB; 44 = 18dB; 48 = 20dB; 50 = 22dB; 54 = 24dB	24 (0dB)	link

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Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/**NRCELL**/cellIndividualSsbRsrqOffset	Cell Individual SSB RSRQ Offset	This parameter defines the cell individual SSB RSRQ offset applicable to a specific cell 3GPP Name: cellIndividualOffset	0 = -24dB; 2 = -22dB; 4 = -20dB; 6 = -18dB; 8 = -16dB; 10 = -14dB; 12 = -12dB; 14 = -10dB; 16 = -8dB; 18 = -6dB; 19 = -5dB; 20 = -4dB; 21 = -3dB; 22 = -2dB; 23 = -1dB; 24 = 0dB; 25 = 1dB; 26 = 2dB; 27 = 3dB; 28 = 4dB; 29 = 5dB; 30 = 6dB; 32 = 8dB; 34 = 10dB; 38 = 12dB; 40 = 14dB; 42 = 16dB; 44 = 18dB; 48 = 20dB; 50 = 22dB; 54 = 24dB	24 (0dB)	link

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Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/NRREL/cellIndividualSsbRsrqOffset	Cell individual SSB RSRQ offset of related neighbor cell	This parameter defines the cell individual SSB RSRQ offset applicable to the related neighbor cell. 3GPP Name: cellIndividualOffset	0 = -24dB; 2 = -22dB; 4 = -20dB; 6 = -18dB; 8 = -16dB; 10 = -14dB; 12 = -12dB; 14 = -10dB; 16 = -8dB; 18 = -6dB; 19 = -5dB; 20 = -4dB; 21 = -3dB; 22 = -2dB; 23 = -1dB; 24 = 0dB; 25 = 1dB; 26 = 2dB; 27 = 3dB; 28 = 4dB; 29 = 5dB; 30 = 6dB; 32 = 8dB; 34 = 10dB; 38 = 12dB; 40 = 14dB; 42 = 16dB; 44 = 18dB; 48 = 20dB; 50 = 22dB; 54 = 24dB	24 (0dB)	link

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Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/filterCoeffSsbRsrp	Filter Coefficient Ssb Rsrp	This parameter specifies L3 filter configuration for RS type SS/PBCH blocks and measurement quantities RSRP from the L1 filter(s). 3GPP Name: ssb-FilterCoefficientRSRP	0 fc0 1 fc1 2 fc2 3 fc3 4 fc4 5 fc5 6 fc6 7 fc7 8 fc8 9 fc9 10 fc11 11 fc13 12 fc15 13 fc17 14 fc19 15 spare1	4 (fc4)	link

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Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/filterCoeffSsbRsrq	Filter Coefficient Ssb Rsrq	This parameter specifies L3 filter configuration for RS type SS/PBCH blocks and measurement quantities RSRQ from the L1 filter(s). 3GPP Name: ssb-FilterCoefficientRSRQ	0 fc0 1 fc1 2 fc2 3 fc3 4 fc4 5 fc5 6 fc6 7 fc7 8 fc8 9 fc9 10 fc11 11 fc13 12 fc15 13 fc17 14 fc19 15 spare1	4 (fc4)	link

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Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/NRREL/fiveGsTac	5G extended tracking area code of related neighbor cell	This parameter identifies the NR extended Tracking Area Code (TAC) for a related neighbor New Radio cell. For New Radio cells, TAC is extended from 2 octets to 3 octets. 3GPP Name: fiveGS-TAC	from 0 to 16777215 step 1	-	link
	MRBTS/NRBTS/NRCELL/NRREL/gNbId	gNB identity of related neighbor cell	This parameter uniquely identifies together with lcrId the related neighbor cell within one PLMN. 3GPP Name: gNB ID	from 0 to 4294967295 step 1	-	link
	MRBTS/NRBTS/NRCELL/NRREL/gNbIdLength	gNB Id length of related neighbor cell	This parameter indicates the length chosen by the operator for NRBTS.nrBtsId of the related neighbor cell . It corresponds to the left most bits of NRCELL.nrCellIdentity.	from 22 to 32 step 1	22	link
	MRBTS/NRBTS/NRCELL/NRREL/lcrId	Local cell resource identifier of related neighbor cell	This parameter uniquely identifies together with gNbId the related neighbor cell within one PLMN.	from 0 to 16383 step 1	-	link

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Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/NRREL/gnbPlmn	PLMN ID in Global gNB ID of related neighbor cell	This parameter structure identifies PLMN of the related neighbor cell. Structure Members: mcc | mnc | mncLength 3GPP Name: PLMN Identity	-	-	link
	MRBTS/NRBTS/NRCELL/NRREL/gnbPlmn::mcc	MCC of PLMN ID in Global gNB ID	This parameter defines the related neighbor cell Mobile Country Code of the PLMN identity.	from 0 to 999 step 1	-	link
	MRBTS/NRBTS/NRCELL/NRREL/gnbPlmn::mnc	MNC of PLMN ID in Global gNB ID	This parameter defines the related neighbor cell Mobile Network Code of the PLMN identity. If NRREL/gnbPlmn::mncLength=2, then NRREL.gnbPlmn.mnc has range 0..99 If NRREL/gnbPlmn::mncLength=3, then NRREL.gnbPlmn.mnc has range 0..999	from 0 to 999 step 1		link
	MRBTS/NRBTS/NRCELL/NRREL/gnbPlmn/mncLength	MNC length of PLMN ID in Global gNB ID	This parameter defines the length of the related neighbor cell Mobile Network Code of the PLMN identity.	from 2 to 3 step 1	-	link

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Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/NRREL/nrRelId	New Radio Neighbor Relation instance identifier	This parameter uniquely identifies the New Radio Neighbor Relation (NRREL) instance within the same containing NRBTS/NRCELL instance.	from 0 to 256 step 1	-	link
	MRBTS/NRBTS/NRCELL/NRREL/nrarfcn	NR Absolute radio frequency channel number of related neighbor cell	This parameter indicates the New Radio Absolute Radio Frequency Channel Number of the related neighbor cell 3GPP Name: ARFCN-ValueNR	from 0 to 3279167 step 1		link
	MRBTS/NRBTS/NRCELL/nroSsbToAverage	Number Of Measurement Ssb To Average	This parameter indicates the maximum number of measurement results per beam based on SS/PBCH blocks to be averaged. The same value applies for each detected cell in that carrier frequency. 3GPP Name: nrofSS-BlocksToAverage	from 2 to 64 step 1	-	link

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Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/NRREL/physCellId	Physical cell identifier of related neighbor cell	This parameter indicates the physical layer cell identity.of the related neighbor cell 3GPP Name: PCI	from 0 to 1007 step 1	-	link
	MRBTS/NRBTS/NRPMRNL/miNrPsCellChange	Measurement Interval for NR PS-Cell Change	This parameter denotes the measurement interval for New Radio PS-Cell Change (NINFC) measurements.	0 disabled 5 5min 15 15min 30 30min 60 60min 360 360min 720 720min 1440 1440min	15 (15min)	link
	MRBTS/NRBTS/NRCELL/sMeasConfigSsbRsrp	s-Measure Configuration Ssb Rsrp	This parameter defines the threshold for P-Cell or PS-Cell (when UE is in EN-DC) measurement controlling when the UE is required to perform measurements associated to neighbouring cells for RS type SS/PBCH blocks and measurement quantities RSRP. 3GPP Name: ssb-RSRP	from 0 to 127 step 1	-	link

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Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/blockHoTimer	Timer for blocking a cell for handover	This parameter indicates the time for which a cell has to be marked as unavailable for Handover after a Handover to the cell failed.	from 0 to 10 step 1 (sec)	0 sec	link
	MRBTS/NRBTS/NRCELL/pciBlackList	List of PCI values for blacklisted cells	This structure gathers the list of PCI values that are blacklisted in each serving cell. Multiplicity: 8 Structure members: physCellId | range Original feature: 5GC000704 Intra-frequency handover via Xn (SA option 2)	-		link
	MRBTS/NRBTS/NRCELL/pciBlackList::physCellId	Physical cell identifier start	This parameter indicates the first physical layer cell identity in a list of PCI values to be statically blacklisted in the serving cell	from 0 to 1007 step 1	-	link

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Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/pciBlackList::range	Physical cell identifier range	This parameter indicates the number of physical cell identifiers in the range (including NRCELL.pciBlackList.physCellId). The UE shall apply value 1 in case the field is absent, in which case only the physical cell identity value indicated by NRCELL.pciBlackList.physCellId applies	4 n4 8 n8 12 n12 16 n16 24 n24 32 n32 48 n48 64 n64 84 n84 96 n96 128 n128 168 n168 252 n252 504 n504 1008 n1008	-	link

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Configuration Management
Related parameters

	Abbreviated name	Full name	Description	Range and step	Default value	Database link
	MRBTS/NRBTS/NRCELL/ssbSmtc1 Duration	Ssb Measurement Timing Duration	This parameter defines the duration of the measurement window in which to receive SS/PBCH blocks. It is given in number of subframes. 3GPP Name: smtc1 duration	0 sf1 1 sf2 2 sf3 3 sf4 4 sf5	-	link
	MRBTS/NRBTS/NRCELL/ssbSmtc1Offset	Ssb Measurement Timing Offset	This parameter defines the offset of the measurement window in which to receive SS/PBCH blocks. It is given in number of subframes. 3GPP Name: smtc1 offset	from 0 to 159 step 1	-	link
	MRBTS/NRBTS/NRCELL/ssbSmtc1Periodicity	Ssb Measurement Timing Periodicity	This parameter defines the periodicity of the measurement window in which to receive SS/PBCH blocks. It is given in number of subframes. 3GPP Name: smtc1 periodicity	0 sf5 1 sf10 2 sf20 3 sf40 4 sf80 5 sf160	-	link

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References and acknowledgments

Reference	Version	Author(s)	Link	Date of access
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5GC000573 CFAM	9.0	Pan Lin	Link	22.10.2019
5GC001094 CFAM	3.3	Yang Liu	Link	22.10.2019
5GC000572 NEI	2.0	Mikolaj Sulkowski	Link	22.10.2019
5GC000573 NEI	2.2	Maciej Florczak	Link	22.10.2019
5GC001904 NEI	2.1	Maciej Florczak	Link	24.10.2019
3GPP TS 37.340: Evolved Universal Terrestrial Radio Access (E-UTRA) and NR Dual Connectivity	15.7.0	3GPP RAN2	Link	22.10.2019

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