LTE2551 RSRQ based A5

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LTE2551 RSRQ based A5

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Introduction

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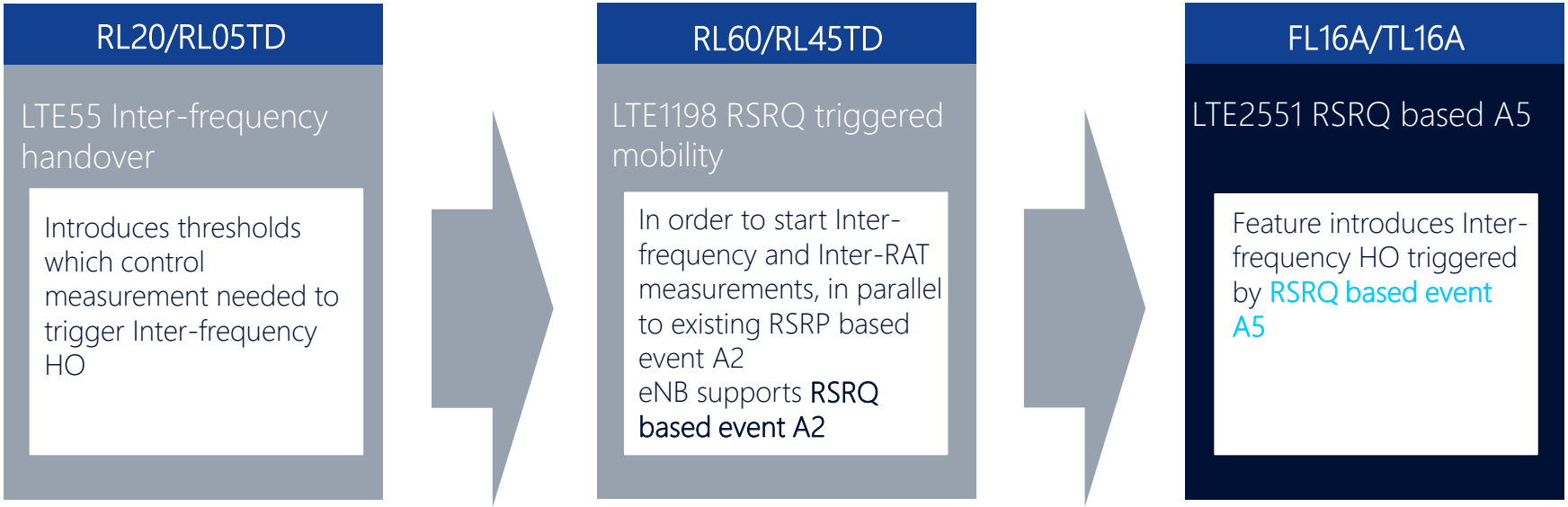
Introduction

Connected mode mobility triggers (Intra-LTE inter-frequency mobility features)



(LTE55)	A2 based RSRP/**RSRQ**	**(LTE1198)**
	A3 based RSRP/RSRQ	
	A5 based RSRP/RSRQ	(LTE2551)

Introduction
Before & after

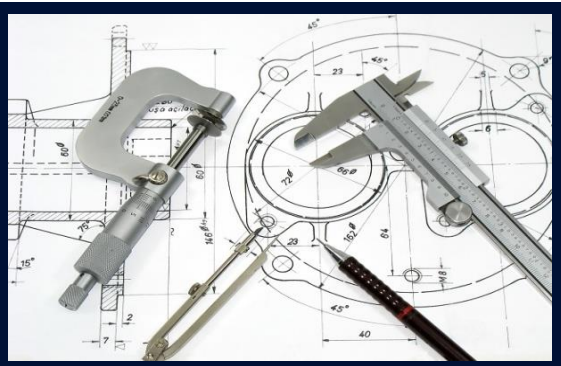
Before LTE2551

- Inter-frequency handover is triggered by **RSRP** based event A5 **only**

After LTE2551

- **Additional RSRQ** based event A5 (serving and neighbor cell) is introduced for handling Inter-frequency handover

Technical Details



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Technical Details

Dependency Table (LTE) LTE2551

Sales information

BSW/ASW	ASW

Release information - macro

FDD LTE	RL release	eNodeB	NetAct
Release/version	FDD-LTE 16A	FL16A	16.8

TDD LTE	RL release	eNodeB	NetAct
Release/version	TD-LTE 16A	FL16A	16.8

Release information – micro/pico/controller

Flexi Zone Micro (FZM/FZP)	RL release	eNodeB	NetAct
Release/version	FDD/TD-LTE 16A	FLF16A/TLF16A	16.8

Flexi Zone Controller (FZC)	RL release	eNodeB	NetAct
Release/version	FDD/TD-LTE 16A	FLC16A/TLC16A	16.8

Release information – general

HW & IOT	HW requirements	MME	SAE GW	UE	Specified by 3GPP
-	FSMr3, AirScale(FDD)	-	-	Rel.8	36.133/36.331

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Technical Details

Mobility thresholds

Before introduction of LTE2551 feature, event A5 for inter-frequency handover is controlled by **RSRP based thresholds**:

Legacy RSRP based thresholds	Event type
threshold3InterFreq	event A5
threshold3aInterFreq	

Event types definition - 3GPP 36.331

Event A5 - PCell becomes worse than threshold1 and neighbour becomes better than threshold2

With LTE2551 feature, new additional **RSRQ based thresholds** are introduced, to control event A5 for inter-frequency handover:

New RSRQ thresholds	Event type	LTE2551
threshold3**Rsrq**InterFreq	event A5	
threshold3a**Rsrq**InterFreq		

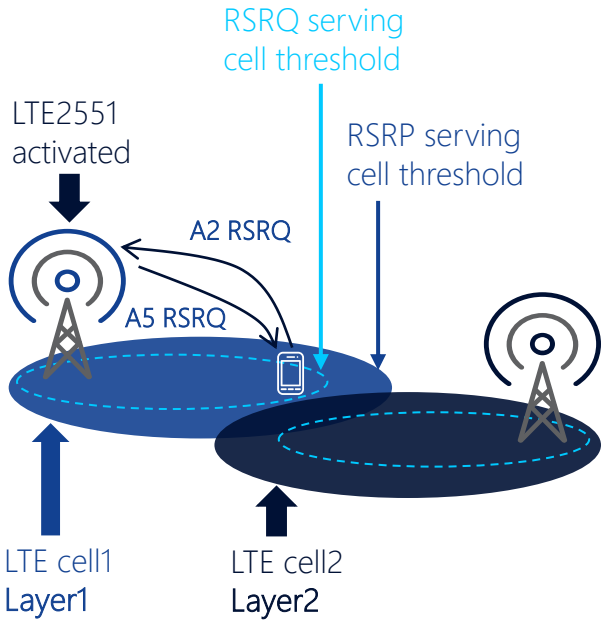
Technical Details

RSRQ in addition to RSRP measurements

- LTE2551 is activated with *LNBTS:actRsrqInterFreqMobility* parameter set to value 'true'

- When feature is enabled, **A5 RSRQ** measurement is configured only in case an **A2 RSRQ** is received
  - Feature **LTE1198** needs to be enabled
- Event **A5** based on **RSRP** is configured only in case an **A2 RSRP** is received

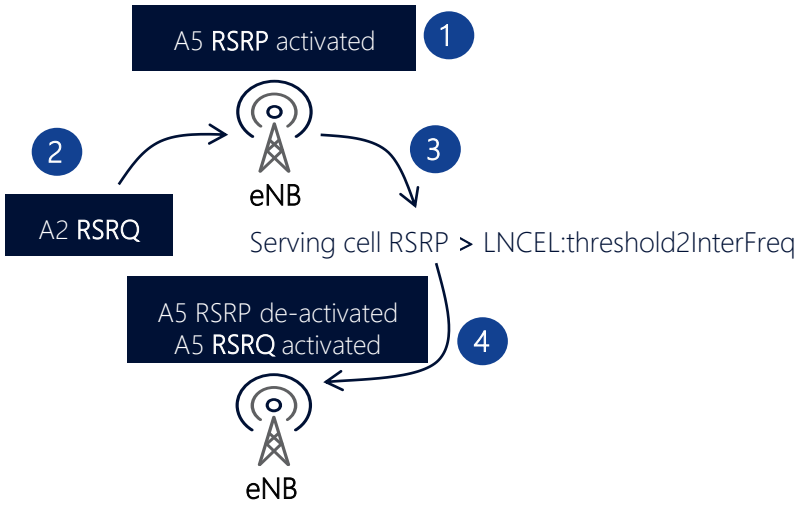
- If LTE2551 is not activated the legacy approach is still in use: RSRP A5 may be configured in case A2 RSRP or A2 RSRQ (LTE1198) is received

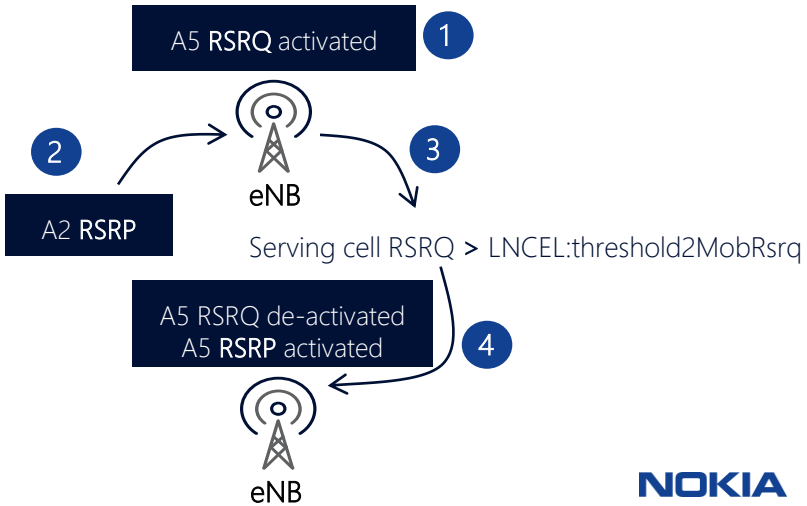


Technical Details

Coexistence of RSRQ and RSRP measurements for event A5

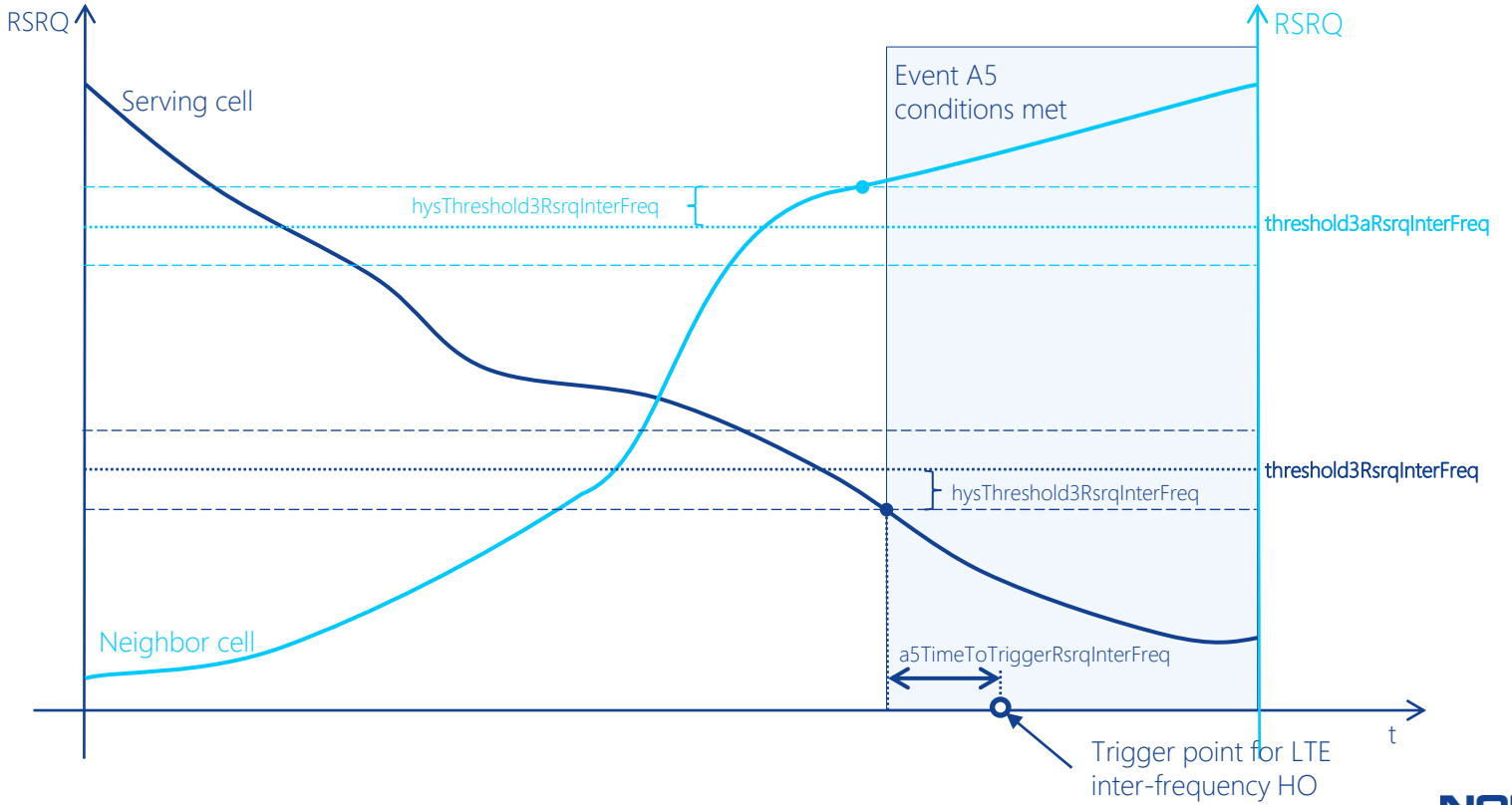
- It may happen that upon receiving of A2 RSRQ event, an A5 RSRP measurement is already active
- eNB checks the serving cell RSRP and if it is greater than the inter-frequency A2 RSRP threshold (configured with parameter LNCEL:threshold2InterFreq), event A5 RSRP is deactivated and A5 RSRQ is enabled
- Otherwise (serving cell RSRP is less than or equal to inter-frequency A2 RSRP threshold) A5 RSRQ is not configured and A5 RSRP is retained
  - The same rules apply if eNB receives RSRP based event A2 from the UE with active RSRQ A5 measurement





Technical Details

Event A5 based on RSRQ measurements

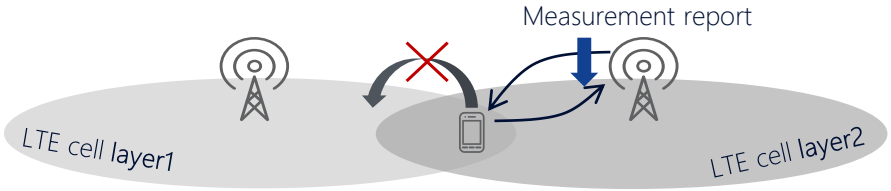


Technical Details

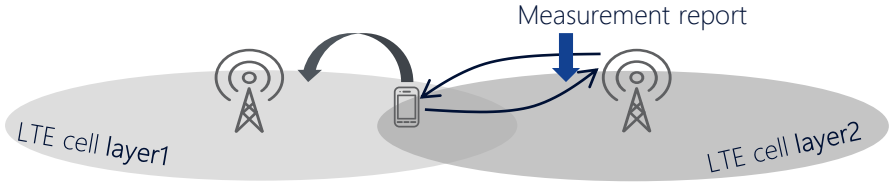
Combined RSRP and RSRQ checks on target inter-frequency cell

When parameter LNBTS:enableCombRsrpRsrq is set to value 'true', then LTE2551 is configured for combined RSRP&RSRQ check of the **target** cell

- In such scenario, handover preperation will be triggered only if radio conditions for both **RSRP** and **RSRQ** thresholds of target cell are met



RSRQ of **neighbor cell** is **lower** than value configured with parameter LNHOIF:threshold3aRsrqInterFreq
RSRP of **neighbor cell** is **higher** than value configured with parameter LNHOIF:threshold3aInterFreq
Handover to neighbor cell is **not triggered**

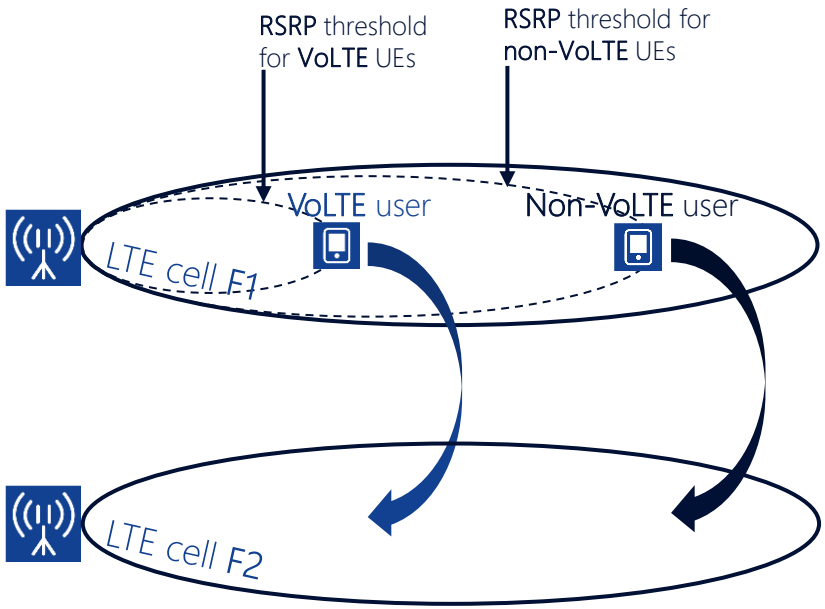


RSRQ of **neighbor cell** is **higher** than value configured with parameter LNHOIF:threshold3aRsrqInterFreq
RSRP of **neighbor cell** is **higher** than value configured with parameter LNHOIF:threshold3aInterFreq
Handover to neighbor cell is **triggered**

Technical Details

VoLTE dedicated thresholds (LTE64)

- When feature LTE64 (Service based mobility thresholds) is activated together with LTE2551, then it is possible to apply **independent** LTE inter-frequency mobility **strategy** for **VoLTE** and **non-VoLTE** users
- When combined check on RSRP and RSRQ is enabled on eNB (*LNBTS:enableCombRsrpRsrq* = true) the **RSRP measurement** is compared against **QCI1 specific threshold** introduced with LTE64
- In such scenario operator is able to apply **different** inter-frequency HO **triggers** for VoLTE and non-VoLTE UEs



Interdependencies

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Interdependencies

prerequisites

LTE55 Inter-frequency handover

Feature needs to be enabled to support Inter-frequency handover based on RSRQ thresholds for event A5 introduced with LTE2551

LTE1198 RSRQ triggered mobility

Feature needs to be enabled so that event A2 based on RSRQ could activate event A5 RSRQ (in legacy behavior **A2 RSRQ** triggers **A5 RSRP** measurements)

Interdependencies

extensions

LTE1060 TDD-FDD handover

Feature needs to be enabled so that handover between TDD and FDD could be performed based on event A5 RSRQ

LTE2008 Extended inter-frequency measurements

Feature introduces enhancement to LTE1060 so that up to 6 instead of 3 FDD&TDD carriers could be measured by UE

Interdependencies

extensions

LTE556 ANR Intra-LTE, Inter-frequency- UE based

If LTE556 is activated together with LTE2551, the new A5 RSRQ reports are considered for passive ANR

LTE64 Service based handover thresholds

Feature introduces dedicated thresholds to start inter-frequency measurements for VoLTE users

Benefits and Gains

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Benefits and Gains

Benefits from the feature

- Introduction of LTE2551 feature improves flexibility in inter-frequency mobility management procedures
- LTE2551 allows to use A5 RSRQ measurement in addition to an A5 RSRP in order to avoid call drops in scenarios with **high interference** (i.e. A2 RSRQ triggers)
- Feature LTE2551 may **prevent** potential inter-frequency **ping-pong handovers** by using combined RSRP&RSRQ checks for selection of target cell

Better **performance** in **high interference** scenarios

Preventing **ping-pong handovers**

Configuration Management

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Configuration Management

Definition of terms and rules for parameter classification*

The **'Basic Parameters'** category contains primary parameters which should be considered during cell deployment and must be adjusted to a particular scenario:

- Network Element (NE) identifiers
- Planning parameters, e.g. neighbour definitions, frequency, scrambling codes, PCI, RA preambles
- Parameters that are the outcome from dimensioning, i.e. basic parameters defining amount of resources
- Basic parameters activating basic functionalities, e.g. power control, admission control, handovers
- Parameters defining operators' strategy, e.g. traffic steering, thresholds for power control, handovers, cell reselections, basic parameters defining feature behaviour

The **'Advanced Parameters'** category contains the parameters for network optimisation and fine tuning:

- Decent network performance should be achieved without tuning these parameters
- Universal defaults ensuring decent network performance need to be defined for all parameters of this category. If this is not possible for a given parameter it must be put to the 'Basic Parameters' category
- Parameters requiring detailed system knowledge and broad experience unless rules for the 'Basic Parameters' category are violated
- All parameters (even without defaults, e.g. optional structures) related to advanced and very complex features

* - purpose: categories of parameters have been defined to simplify network parameterization. Parameterization effort shall be focused mainly on parameters included in basic category. Categorization is reflected in a 'view' definition in NetAct CM Editor (released in RL60) i.e. parameters will be displayed according to the category: either in the 'Basic parameters' view or the 'Advanced parameters' view.

Configuration Management

New parameters

Abbreviated name	Full name	PKDB link
LNBTS:actRsrqInterFreqMobility	Activate RSRQ-based A5	Parameter Knowledge Database
LNBTS:enableCombRsrpRsrq	Enable combined RSRP and RSRQ check	Parameter Knowledge Database

Configuration Management

New parameters

Abbreviated name	Full name	PKDB link
LNHOIF:a5TimeToTriggerRsrqInterFreq	RSRQ A5 inter-frequency time to trigger	Parameter Knowledge Database
LNHOIF:a5ReportIntervalRsrqInterFreq	RSRQ A5 inter-frequency report interval	Parameter Knowledge Database
LNHOIF:hysThreshold3RsrqInterFreq	RSRQ A5 inter-frequency hysteresis	Parameter Knowledge Database
LNHOIF:threshold3RsrqInterFreq	RSRQ A5 inter-frequency threshold1	Parameter Knowledge Database
LNHOIF:threshold3aRsrqInterFreq	RSRQ A5 inter-frequency threshold2	Parameter Knowledge Database
LNHOIF:rsrqA5InterFreqMobilityParams	A5 RSRQ inter-frequency mobility parameters	Parameter Knowledge Database

Configuration Management

Related parameters

Abbreviated name	Full name	PKDB link
LNCEL:threshold2InterFreq	Threshold th2 interFreq for RSRP	Parameter Knowledge Database
LNCEL:hysThreshold2InterFreq	Related hysteresis of threshold th2 interFreq of RSRP	Parameter Knowledge Database

Configuration Management

Related parameters

Abbreviated name	Full name	PKDB link
LNHOIF:threshold3InterFreq	Threshold th3 for RSRP inter frequency	Parameter Knowledge Database
LNHOIF:threshold3aInterFreq	Threshold th3a for RSRP inter frequency	Parameter Knowledge Database
LNHOIF:a5TimeToTriggerInterFreq	A5 time to trigger inter frequency	Parameter Knowledge Database
LNHOIF:a5ReportIntervalInterFreq	A5 report interval inter frequency	Parameter Knowledge Database
LNHOIF:hysThreshold3InterFreq	Related hysteresis of thresholds th3 and th3a for RSRP	Parameter Knowledge Database

Configuration Management

Related parameters

Abbreviated name	Full name	PKDB link
LNHOIF:threshold3InterFreqQci1	Threshold th3 for RSRP inter frequency during QCI1	Parameter Knowledge Database
LNHOIF:threshold3aInterFreqQci1	Threshold th3a for RSRP inter frequency during QCI1	Parameter Knowledge Database

Configuration Management

Related parameters

Abbreviated name	Full name	PKDB link
LNCEL:threshold2MobRsrq	Threshold th2a for RSRQ mobility	Parameter Knowledge Database
LNCEL:hysThreshold2MobRsrq	Related hysteresis of threshold Th2 for RSRQ mobility	Parameter Knowledge Database
LNCEL:a2TimeToTriggerMobRsrq	Time to trigger for A2 by RSRQ to start mobility measurements	Parameter Knowledge Database
LNCEL:a2TimeToTriggerActInterFreqMeas	Time to trigger for A2 to activate inter freq measurement	Parameter Knowledge Database
LNCEL:threshold2InterFreqQci1	Threshold Th2 Inter Freq for RSRP during QCI1	Parameter Knowledge Database

Deployment Aspects

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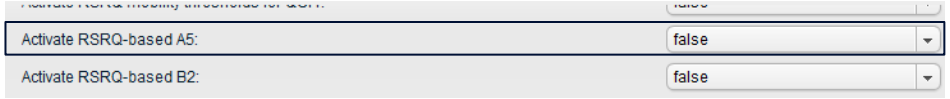
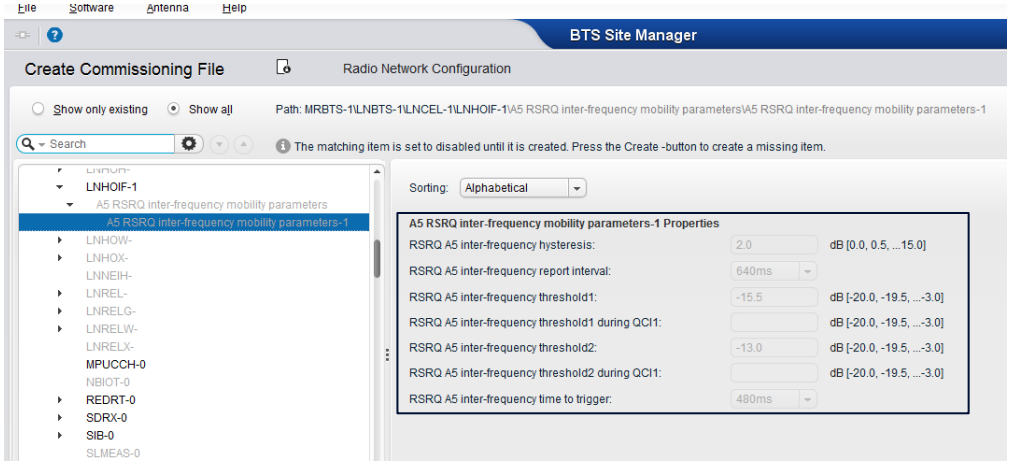
Deployment Aspects
Feature activation

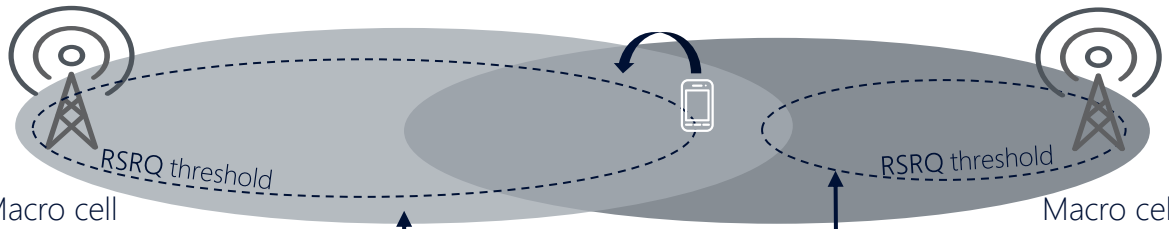
- Feature LTE2551 is activated by setting the *LNBTS:actRsrqInterFreqMobility* to value 'true'
- Parameters introduced with LTE2551 are located under LNHOIF MOC
- *LNHOIF:rsrqA5InterFreqMobilityParams* structure contains TTT, threshold and hysteresis parameters related to RSRQ based A5 functionality





Deployment Aspects

Deployment scenario with two overlapping LTE frequency layers



Macro cell
(On LTE layer **F1**)

Macro cell
(On LTE layer **F2**)

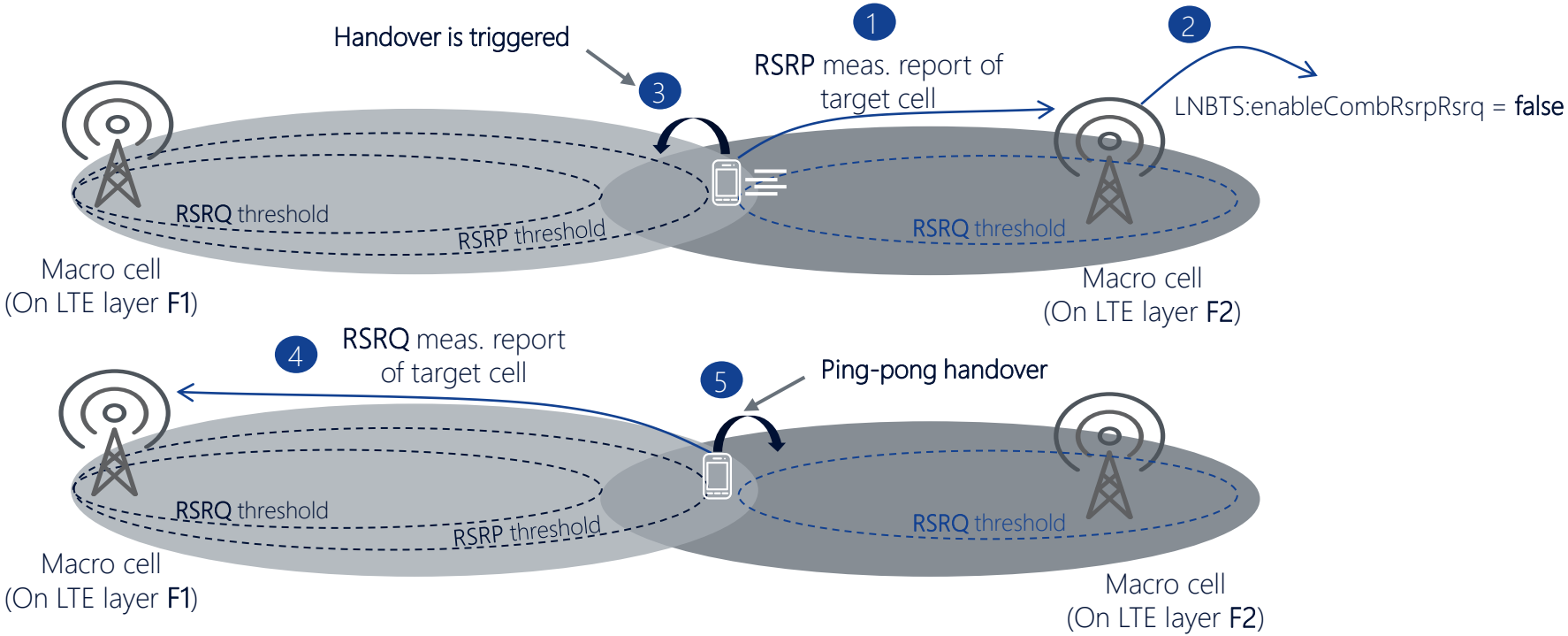
Serving cell threshold for activation of A5 based RSRQ measurement is defined by parameter LNHOIF:threshold3RsrqInterFreq

Neighbor cell threshold for activation of A5 based RSRQ measurement is defined by parameter LNHOIF:threshold3aRsrqInterFreq

Event A5 may be started **earlier** by RSRQ based thresholds for serving cell (**LNHOIF:threshold3RsrqInterFreq**) and neighbor cell (**LNHOIF:threshold3aRsrqInterFreq**)

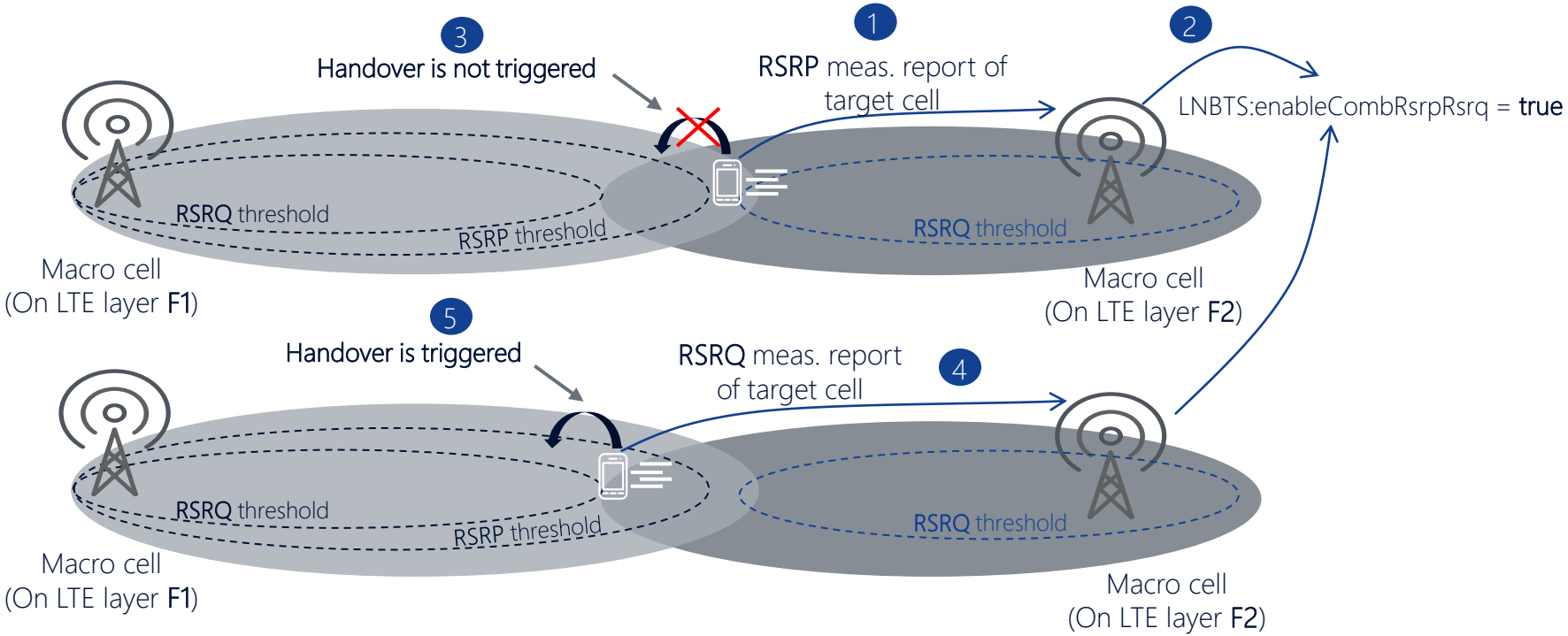
Deployment Aspects

Scenario with ping-pong handovers (combined check on RSRP&RSRQ disabled)



Deployment Aspects

Scenario without ping-pong handovers (combined check on RSRP&RSRQ enabled)



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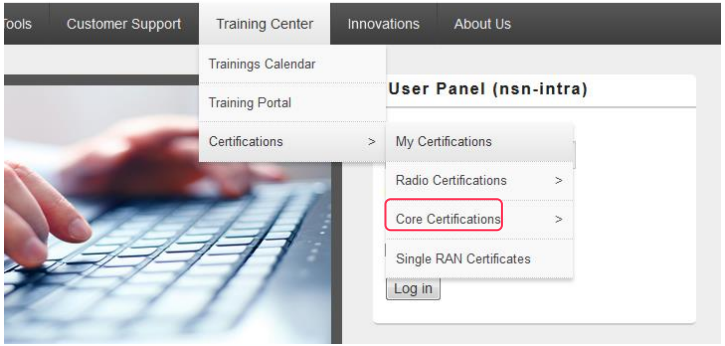

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Performance Aspects

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Performance Aspects

New counters

LTE2551 does not introduce any new counters and KPIs. Existing counters/KPIs can be analyzed to prove that feature works.

Performance Aspects
Feature impact

Feature impact	How to measure?
Before LTE2551 all A5 Inter-frequency HOs are triggered **RSRP** - based only. Those HOs may **fail** in case of **low RSRQ** in **target** cell (high interference), causing **re-establishment procedure** trigger. **Every** failed re-establishment leads to **call drop.** The **increase** in Inter-frequency handover **success ratio** and **decrease** in **amount** of **re-establishment attempts** is expected after activation of LTE2551 feature	**KPI:** - **LTE_5115a** E-UTRAN Inter-Frequency HO Success Ratio Measurement Gap assisted **Counters:** - HO_INTFREQ_GAP_ATT (M8021C1) - HO_INTFREQ_GAP_SUCC (M8021C3) $LTE\_5115a = \frac{HO\_INTFREQ\_GAP\_SUCC}{HO\_INTFREQ\_GAP\_ATT} \times 100\%$ **KPI:** - **LTE_5141a** RRC Connection Re-establishment Attempts, HO fail **Counter:** - RRC_CON_RE_ESTAB_ATT_HO_FAIL (M8008C6) $LTE\_5141a = sum\ (RRC\_CON\_RE\_ESTAB\_ATT\_HO\_FAIL)$


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