BIG DATA &
NETWORK ENGINEERING

LTE2832 SRVCC due to admission control rejection

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LTE2832 SRVCC due to admission control rejection

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Introduction

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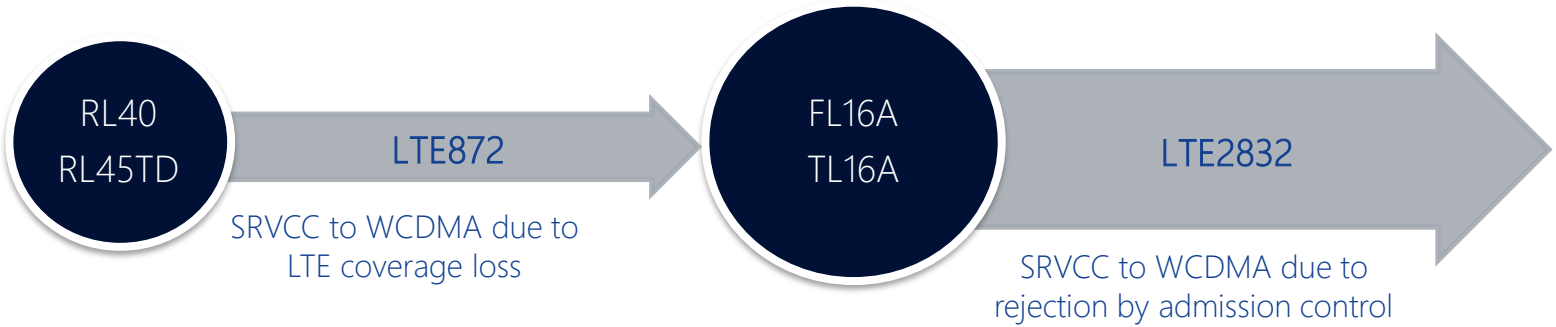
Introduction

Single Radio Voice Call Continuity to WCDMA

- Coverage triggered SRVCC to WCDMA
  - In Nokia product the SRVCC to WCDMA, which moves the VoLTE users towards WCDMA is supported by LTE872 from RL40/RL45TD onwards
- Admission Control rejection triggered SRVCC to WCDMA
  - With **LTE2832**, SRVCC to WCDMA is triggered in case new requested voice call may not be handled by LTE cell due to Admission Control rejection



Introduction
Before & after

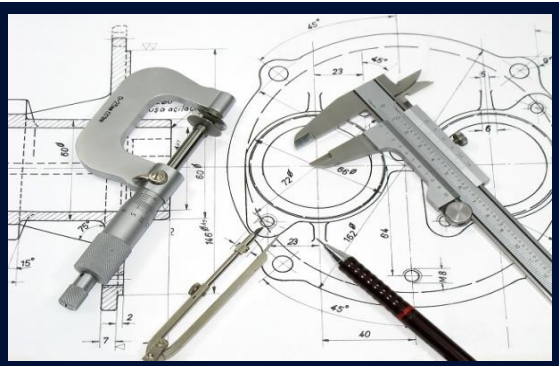
Before FL16A

- Admission Control rejects the E-RAB setup request for QCI1 bearer in case of lack of AC resources
- In this case, if ARP preemption cannot help to admit a voice call, UE is stuck on LTE side, without established voice call
- VoLTE call (QCI1) setup success ratio reduced

After FL16A

- In case of lack of Admission Control resources, eNB allows for temporary establishment of voice call just to make SRVCC to WCDMA possible
- UE is moved to WCDMA domain, where voice call, temporary established on LTE side, is continued
- Voice call setup success ratio improved

Technical Details



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Technical Details

Dependency Table

Sales information

BSW/ASW	ASW

Release information - macro

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

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

Release information – micro/pico/controller

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

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

Release information – general

HW & IOT	HW requirements	MME	SAE GW	UE	Specified by 3GPP
	FSMF, AirScale(FDD)			3GPP Rel.8	

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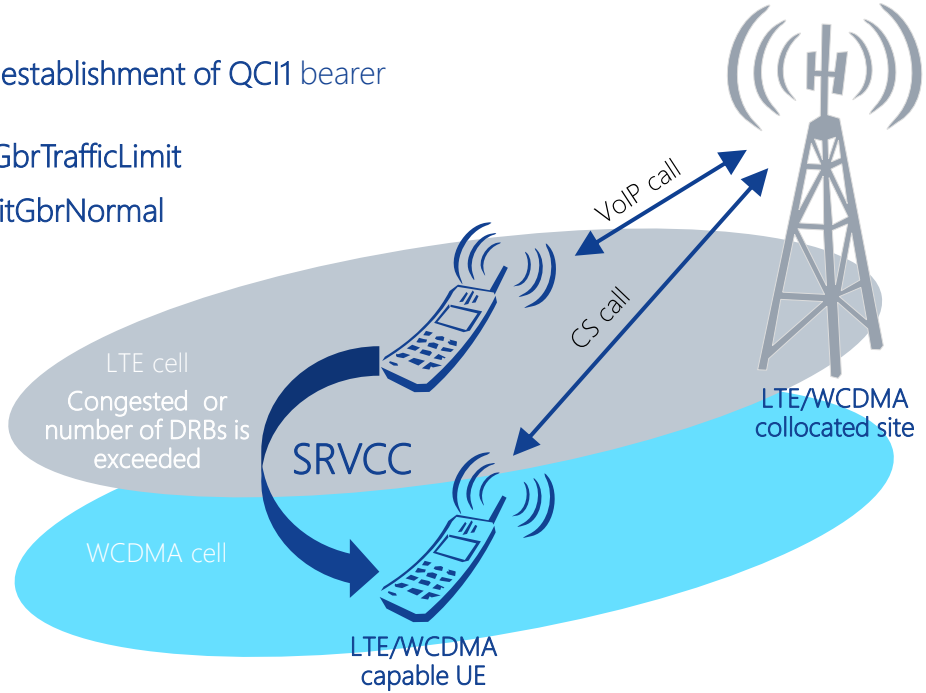
Feature in nutshell

LTE2832 SRVCC due to admission control rejection

- Modified Admission Control operation allows for **temporary establishment of QCI1** bearer in LTE serving cell even if:
  - GBR traffic has reached the limit defined by **LNCEL:maxGbrTrafficLimit**
  - GBR traffic has reached the limit defined by **LTAC:tacLimitGbrNormal**
  - Maximum number of DRBs has reached the limit defined by **LNCEL:maxNumActDrb**
- The modified behavior of the Admission Control, applies only for establishment of QCI1 DRBs requested by **S1AP: E-RAB SETUP REQUEST***
- Prior to the actual SRVCC to WCDMA procedure **B1 event based measurements are performed**

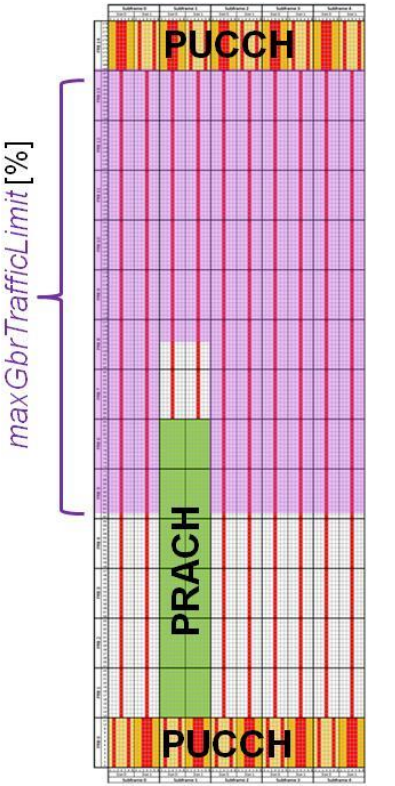


* For other messages requesting bearer establishment (S1AP: INITIAL CONTEX SETUP REQUEST, S1AP: HANDOVER REQUEST, X2AP: HANDOVER REQUEST), the AC logic remains unchanged

Radio admission control function

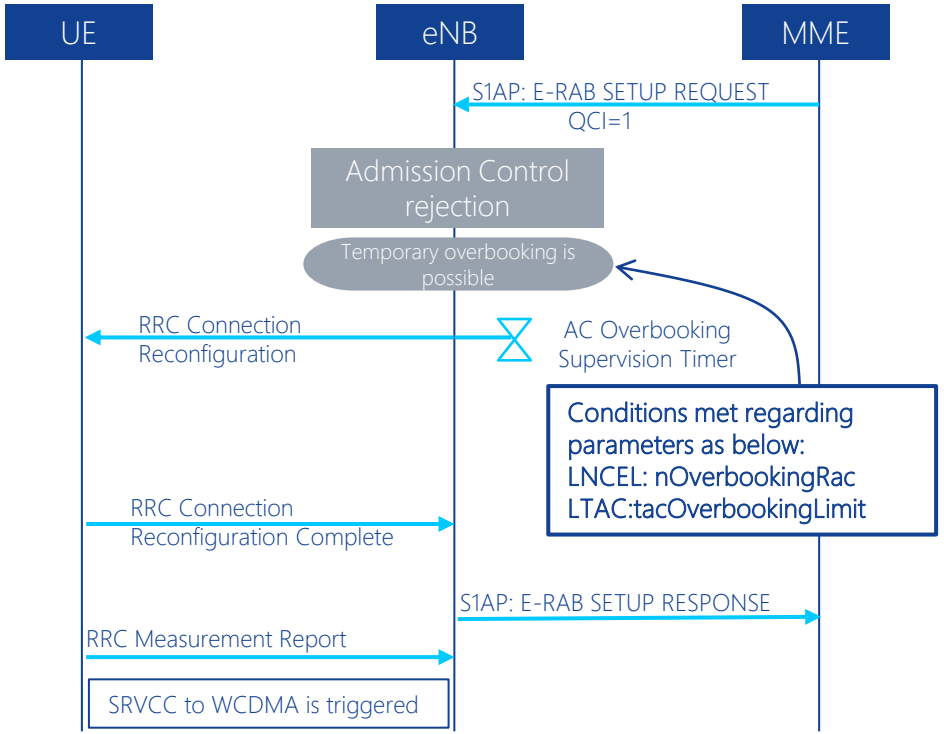
LTE2832 SRVCC due to admission control rejection

- LTE497 Smart admission control and LTE534 ARP-based Admission Control for E-RABs are the prerequisites for LTE2832 SRVCC due to admission control rejection
  - Both AC related features are activated together
- maxGbrTrafficLimit is introduced by Smart Admission Control, it defines the maximum radio resources consumption for GBR traffic
- If all resources are used by different GBR QCIs (maxGbrTrafficLimit reached), and new QCI1 is to be established then:
  - LTE534 ARP-based Admission Control for E-RABs functionality tries to release QCIs with lower ARP priority to provide resources for establishement of new QCI1 bearer
  - If LTE534 will not preempt other bearers to find and alocate resources to admit the new voice call, then LTE2832 will be used, if HO to WCDMA is possible



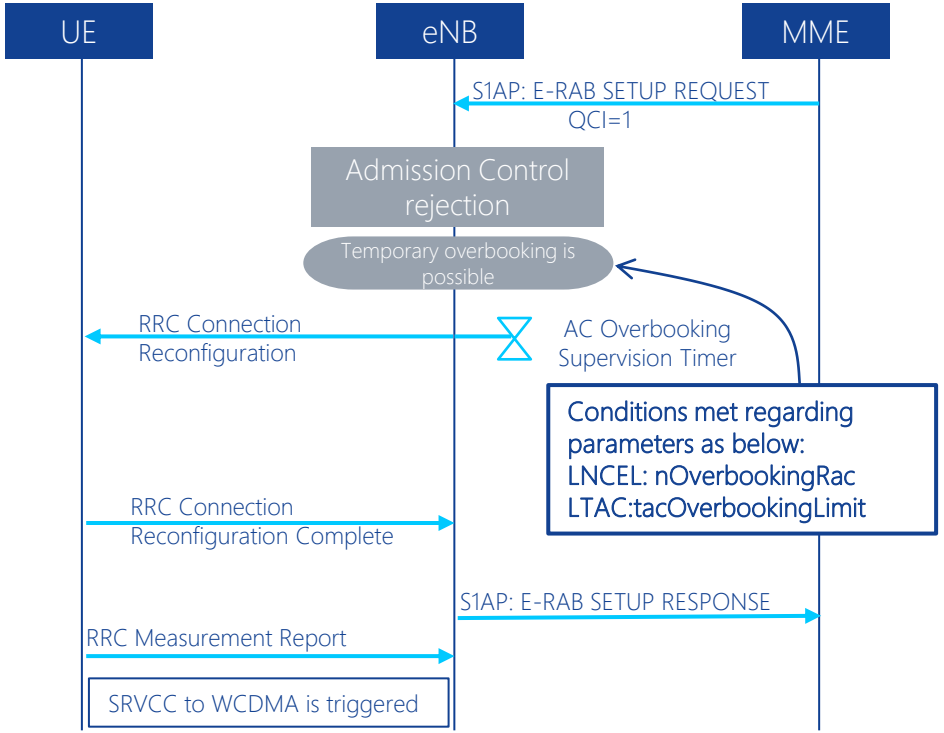
LTE2832 SRVCC due to admission control rejection 1/5

- LTE2832 is enabled by feature activation flag **LNBTS: actAcSrvcc**
- MME sends an **S1AP:E-RAB SETUP REQUEST** to setup a **QCI1 bearer**
- **Radio Admission Control (RAC)** detects that it is not possible to handle voice call
- Nevertheless, eNB establishes temporary the **DRB with QCI1** and additionally configures the UE with **event B1** based measurements
- **LNCEL:nOverbookingRac** defines the maximum number of parallel ongoing procedures for which temporary overbooking is possible



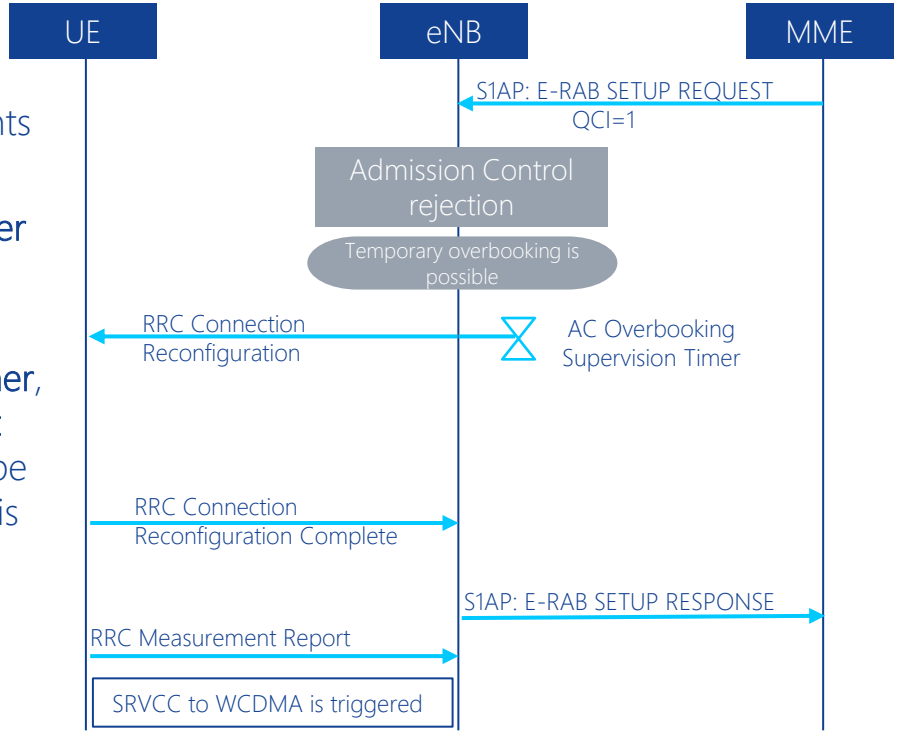
LTE2832 SRVCC due to admission control rejection 2/5

- Transport Admission Control (TAC) thresholds are also checked for temporary overbooking
  - LTAC:tacOverbookingLimit defines the maximum number of parallel ongoing procedures for which temporary overbooking is possible
    - This check is used when GBR traffic reaches the limit defined by LTAC:tacLimitGbrNormal



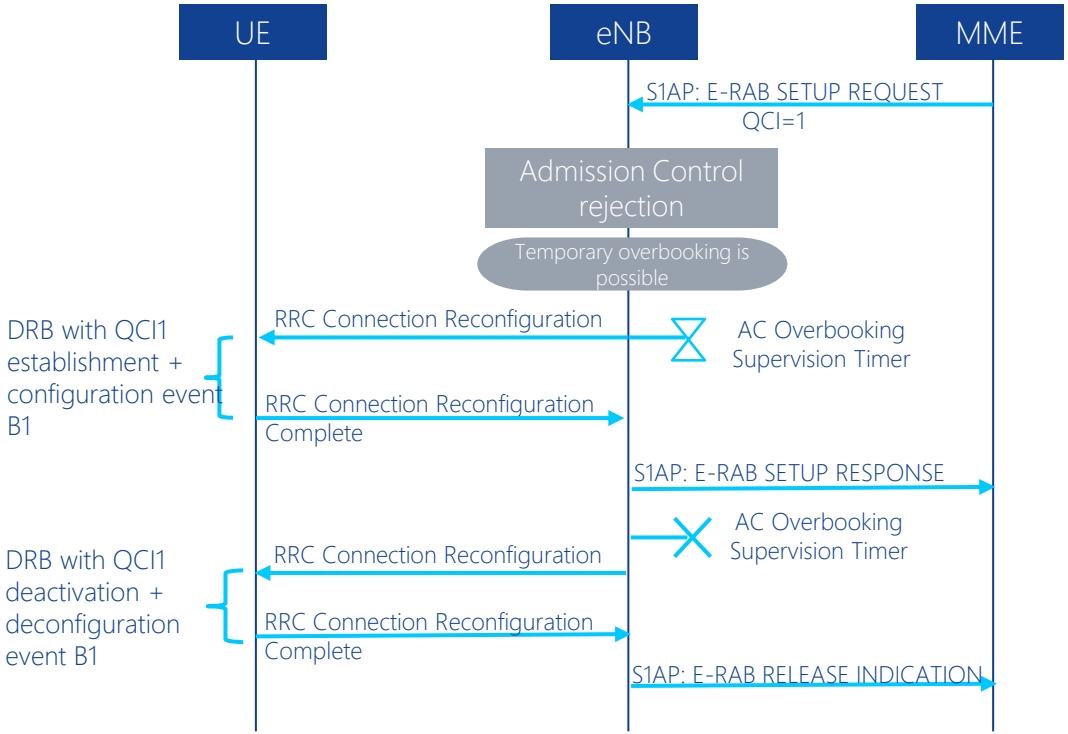
LTE2832 SRVCC due to admission control rejection 3/5

- eNB establishes temporary the **DRB with QCI1** and configures the UE with **event B1** based measurements within **RRC:ConnectionReconfiguration**
- At the same time **AC Overbooking Supervision Timer** controlled by parameter **LNBTS:tOverbookingAc** is started
- If during ongoing **AC Overbooking Supervision Timer**, eNB receives from the UE **RRC:MeasurementReport** with **event B1 or B2** 'HO to WCDMA' (which could be previously installed), SRVCC to WCDMA procedure is triggered
- Execution completion phase is the same as the one triggered by LTE coverage SRVCC introduced by LTE872



LTE2832 SRVCC due to admission control rejection 4/5

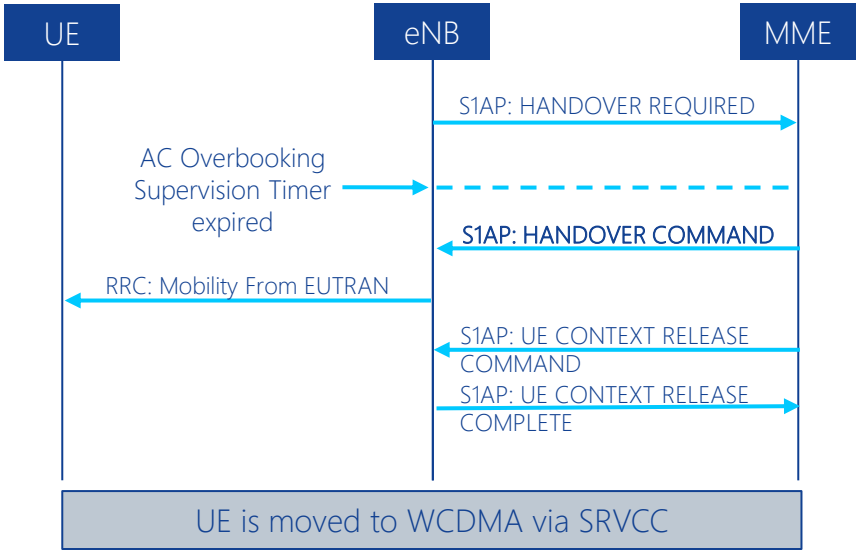
- eNB establishes temporary the **DRB with QCI1** and configures the UE with **event B1** based measurements within RRC:ConnectionReconfiguration
- AC Overbooking Supervision Timer expired before preparation phase
- eNB releases E-RAB with QCI1



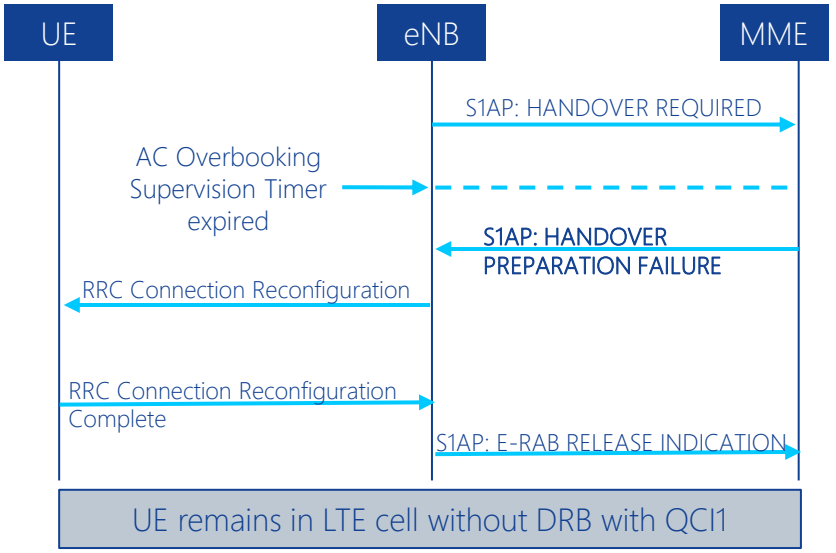
LTE2832 SRVCC due to admission control rejection 5/5

- At **AC Overbooking Supervision Timer** expiry during preparation phase, the eNB is awaiting for the reply from MME

In case of successful preparation (S1AP:HANDOVER COMMAND received), **SRVCC is continued**

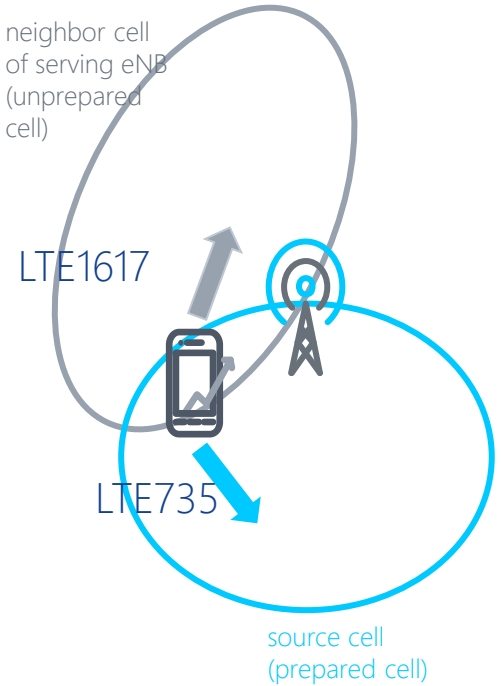


In case of unsuccessful preparation (S1AP:HANDOVER PREPARATION FAILURE received), **the eNB relaeses E-RAB with QCI1**



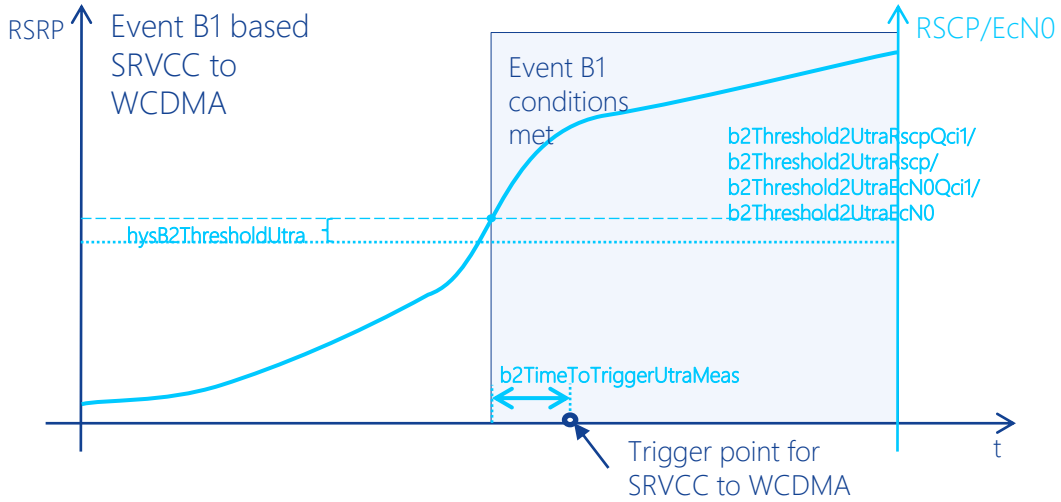
Interaction with Re-establishment procedure

- During execution phase t304 timer (controlled by t304InterRAT(LNCEL) for PSHO and SRVCC to WCDMA) is started with RRC: Mobility From EUTRAN message
- In case SRVCC execution fails due to t304 expiry (UE not accessed the target WCDMA cell), **re-established procedure is triggered** by the UE :
  - With **LTE735** re-establishment triggered to source cell is supported
    - No further SRVCC is attempted and overbooked E-RAB is released immediately
  - With **LTE1617** re-establishment triggered to other cell of source eNB or to cell of other eNB is supported
    - if the RLF triggered HO is successful, the temporary admitted bearer will be established in the target cell as a regular bearer



LTE2832 SRVCC due to admission control rejection

Compared to LTE872 where event B2 is used for SRVCC, with LTE2832 **event B1** is used



Hysteresis and TimeToTrigger are controlled by legacy parameters applicable for event B2:

- LNHOW:hysB2ThresholdUtra
- LNHOW:b2TimeToTriggerUtraMeas

Event B1, is controlled by part of legacy parameters introduced by LTE56 inter-RAT to WCDMA or LTE64 service based mobility thresholds, applicable for event B2:

- LNHOW:b2Threshold2UtraRscp
- LNHOW:b2Threshold2UtraEcN0
- LNHOW:b2Threshold2UtraRscpQci1
- LNHOW:b2Threshold2UtraEcN0Qci1

Note:
If parameters b2Threshold2UtraEcn0Qci1 and b2Threshold2UtraRscpQci1 are not configured then parameters b2Threshold2UtraEcn0 or b2Threshold2UtraRscp are used

Which entity (Rscp or EcN0) is used for monitoring of WCDMA cell is controlled by parameter LNCEL:measQuantityUtra

Interdependencies

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Interdependencies

prerequisites

- LTE872 SRVCC to WCDMA

  Feature must be activate to enable SRVCC functionality

- LTE496 Support of QCI 2, 3 and 4
  LTE497 Smart Admission Control
  LTE534 ARP-based Admission Control for E-RABs

  All features are activated by the same flag: actEnhAcAndGbrServices.
  The smart Admission control functionality for RAC must be activate to allow overbooking

Interdependencies

limitations

- LTE1170 Inter eNodeB IF Load Balancing
- LTE1387 Intra eNodeB IF Load Balancing
- LTE1531 Inter-frequency load balancing extension
- LTE1841 Inter-frequency load equalization

  Features use A4 measurements for load balancing. With LTE2832 the A4 measurements are deactivated when WCDMA B1 measurements are activated

- LTE2275 Pcell swap

  No Pcell swap is triggered as long as WCDMA B1 measurements are activated

Interdependencies

limitations

- LTE2612 ProSe Direct Communications for Public Safety

  UEs which are configured for sidelink communication are not subject to overbooking. If an overbooked E-RAB and sidelink communication are set up, LTE2612 deconfigures all WCDMA measurements (exept B1 for CSFB) for UE. The Admission Control supervision timer expires as no measurement is received. Consequently, AC triggered SRVCC does not work for UE with a sidelink communication

- LTE55 Inter frequency Handover

  When B1 measurements are activated because of SRVCC, A3 or A5 inter frequency handover measurements are deactivated and this layer measurement gaps are only ocupated by measurements of WCDMA layer

Interdependencies

limitations

- LTE1127 Service-based Handover

  Feature triggers a service-based intra-LTE inter-frequency handover. With LTE2832 a service-based handover is not applicable to E-RABs which are only admitted by overbooking. LTE1127 and LTE2832 may be activated independent of each other

Benefits and Gains

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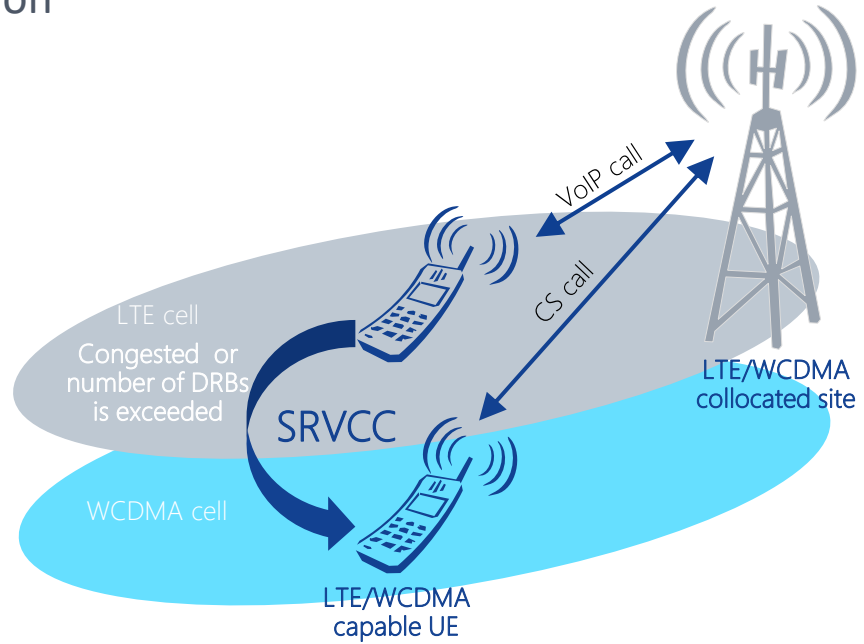
Benefits and Gains

LTE2832 SRVCC due to admission control rejection

- With this feature UEs which earlier were rejected by Admission Control and were not able to establish voice call, **now can establish voice call** and can be moved from congested LTE cell towards CS domain of WCDMA
  - user experience is improved
- It may be expected that **Success Ratio for QCI1 establishment will be improved** (see: KPI **LTE_5204c**) – this will be especially visible in highly loaded cells/network areas, where congestion appears



Configuration Management

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Configuration Management

New parameters

Abbreviated name	Full name	PKDB link
LNBTS: actAcSrvcc	Activate AC triggered SRVCC	Parameter Knowledge Database
LNBTS: tOverbookingAc	AC overbooking supervision timer	Parameter Knowledge Database
LNCEL: nOverbookingRac	RAC overbooking limit	Parameter Knowledge Database
LTAC: tacOverbookingLimit	TAC overbooking limit	Parameter Knowledge Database
APTAC: tacOverbookingLimit*	TAC overbooking limit	

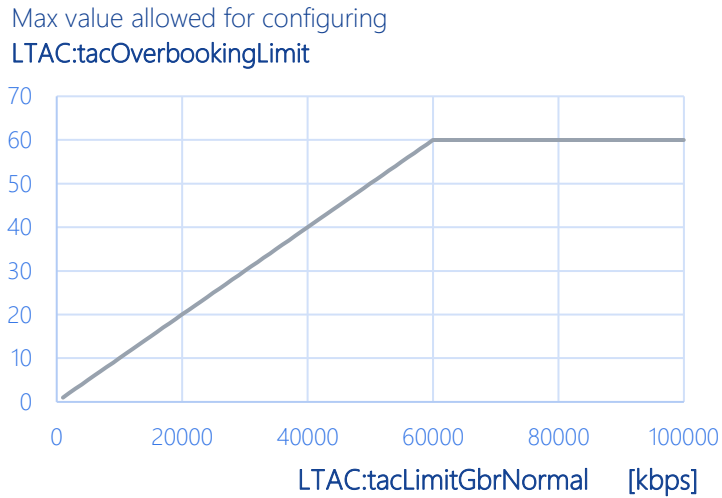
Note:
(*) For FLC16A, TLC16A product

Configuration Management

Maximum possible value for tacOverbookingLimit

LTAC:tacOverbookingLimit = max(min(60, Integer[10% * **LTAC:tacLimitGbrNormal** / 100 kbps]),1)

LTAC:tacLimitGbrNormal	max value allowed for LTAC:tacOverbookingLimit
1000kbps	1
2000kbps	2
3000kbps	3
…	
59000kbps	59
60000kbps	60
60100kbps and any higher value	60 always for any LTAC:tacLimitGbrNormal above 60000kbps



Maximum possible value for configuring TacOverbookingLimit is achieved with tacLimitGbrNormal set to 60 Mbps. For higher values than 60Mbps, tacOverbookingLimit will be always 60. For lower values than 60 Mbps, the maximum possible value for configuring TacOverbookingLimit is shown on the chart.

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Configuration Management

Related parameters 1/2

Abbreviated name	Full name	PKDB link
LNCEL:maxGbrTrafficLimit	Maximum GBR-DRB Traffic Limit	Parameter Knowledge Database
LNCEL:maxNumActDrb	Max number act DRB	Parameter Knowledge Database
LTAC:tacLimitGbrNormal	TAC limit GBR normal	Parameter Knowledge Database
LNHOW:hysB2ThresholdUtra	Related hysteresis thresholds B2Th1, B2Th2 HO WCDMA	Parameter Knowledge Database
LNHOW:b2TimeToTriggerUtraMeas	Time to trigger UTRA measurement report	Parameter Knowledge Database
LNCEL:measQuantityUtra	Measurement quantity used for UTRA FDD measurements	Parameter Knowledge Database

Configuration Management

Related parameters 2/2

Abbreviated name	Full name	PKDB link
LNHOW:b2Threshold2UtraRscp	Threshold2 UTRA for RSCP neighbour cell	Parameter Knowledge Database
LNHOW:b2Threshold2UtraEcN0	Threshold2 UTRA for ecNo neighbour cell	Parameter Knowledge Database
LNHOW:b2Threshold2UtraRscpQci1	Threshold2 UTRA for RSCP neighbour cell during QCI1	Parameter Knowledge Database
LNHOW:b2Threshold2UtraEcN0Qci1	Threshold2 UTRA for ecNo neighbour cell during QCI1	Parameter Knowledge Database

Deployment Aspects

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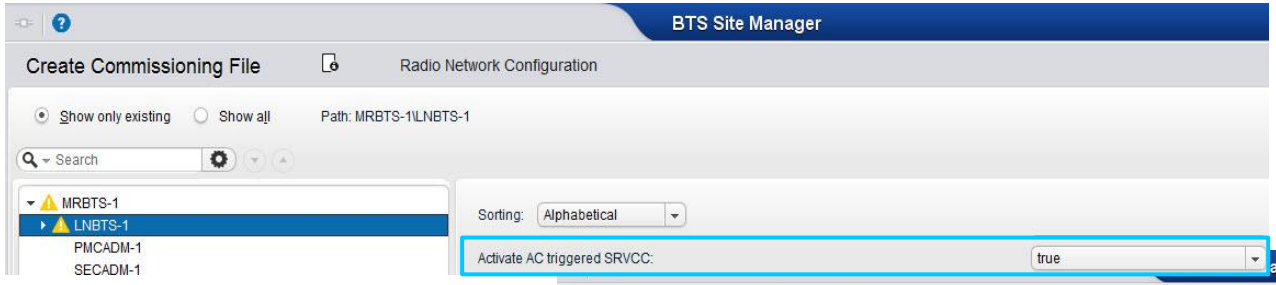
Deployment Aspects

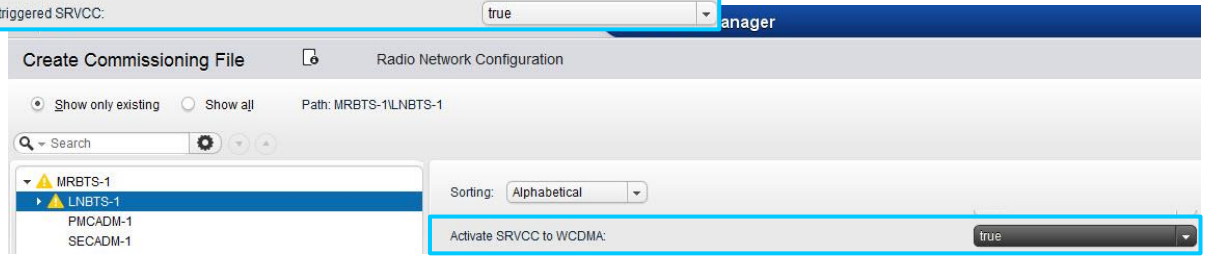
BTS Site Manager configuration

STEP 1

Following parameters must be configured:

- LNBTS: actSrvccToWcdma and LNBTS: actAcSrvcc must be set to 'true'



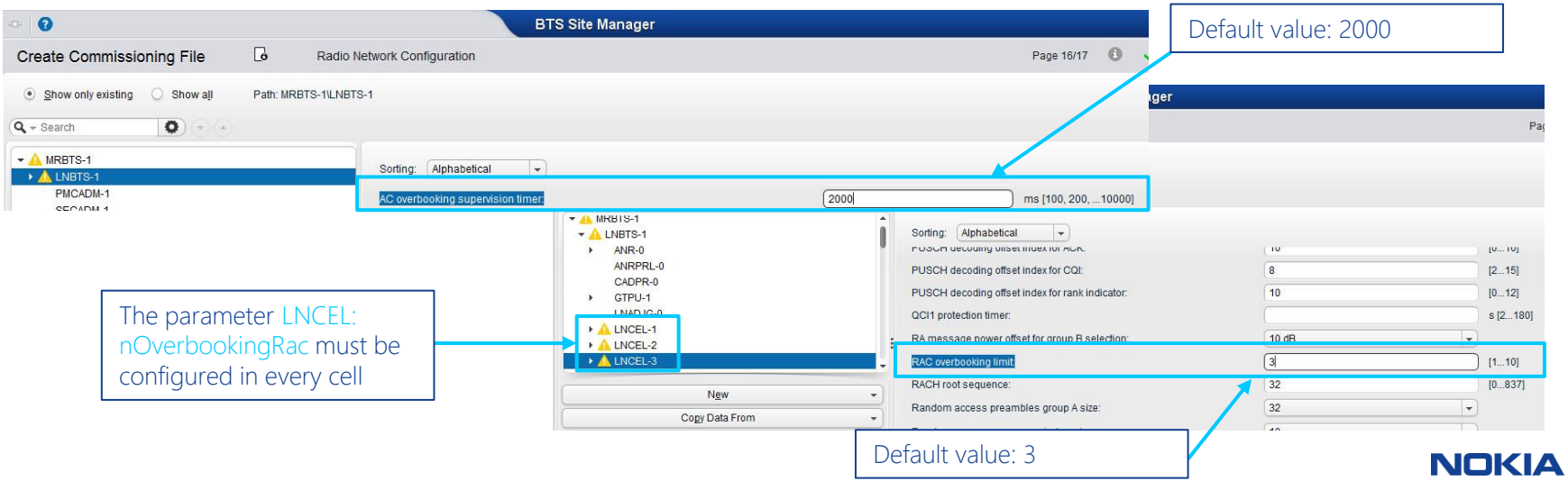


Deployment Aspects

BTS Site Manager configuration

STEP 2

- The parameter LNBTS: tOverbookingAc must be configured
- The parameter LNCEL: nOverbookingRac must be configured in every cell

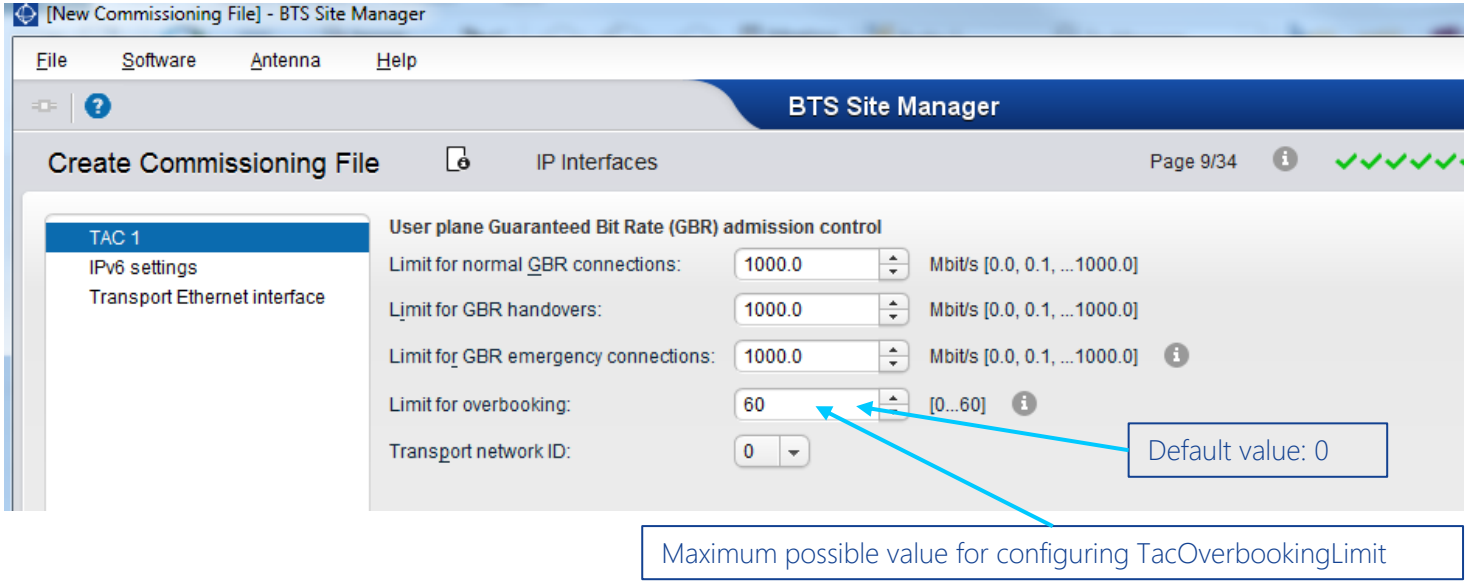


Deployment Aspects

BTS Site Manager configuration

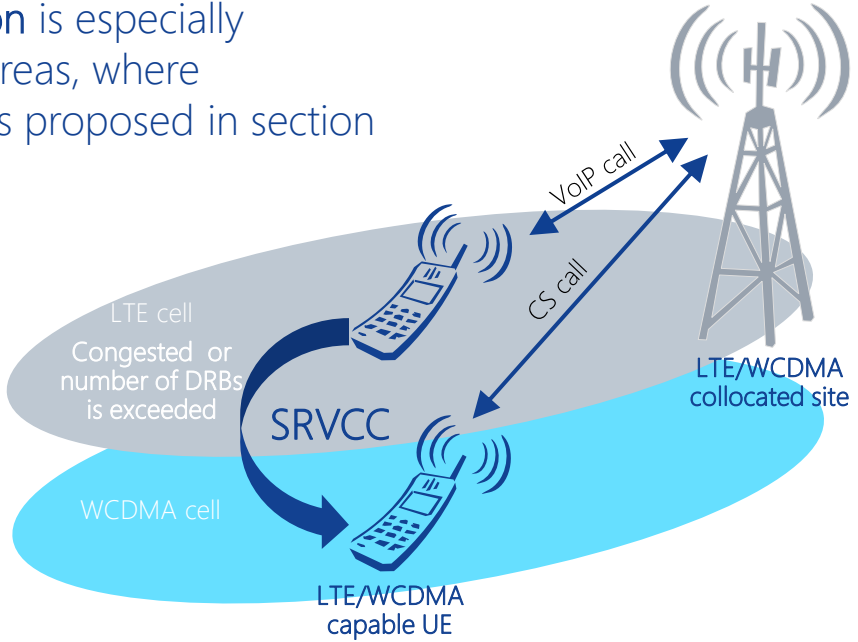
STEP 3

- The parameter LTAC: tacOverbookingLimit must be configured



Deployment Aspects

- LTE2832 SRVCC due to admission control rejection is especially recomended in the highly loaded cells/network areas, where congestion appears; this can be achived by KPI as proposed in section Performance Aspects
- With this feature it is expected that existing KPI (LTE_5204c) E-UTRAN E-RAB Setup Success Ratio, QCI1, will improve



Performance Aspects

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Performance Aspects

New counters

Feature LTE2832 introduced 6 new counters

Counter name	Description
ERAB_SUCC_RAC_TEMP_QCI1 (M8006C299) #LTE EPS Bearer	This measurement provides the number of successful temporary QCI1 bearer setup completion due to an overbooking done by the radio admission control (RAC). Trigger event: This counter will be incremented on transmission of an S1AP: E-RAB SETUP RESPONSE message (source eNB -> MME; 3GPP TS 36.413) indicating that a temporary QCI1 bearer is admitted successfully in case that the bearer was only temporarily setup due to an overbooking done by the radio admission control (RAC).

Performance Aspects

New counters

Feature LTE2832 introduced 6 new counters

Counter name	Description
ERAB_SUCC_TAC_TEMP_QCI1 (M8006C300) #LTE EPS Bearer	This measurement provides the number of successful temporary QCI1 bearer setup completion due to an overbooking done by the transport admission control (TAC). Trigger event: This counter will be incremented on transmission of an S1AP: E-RAB SETUP RESPONSE message (source eNB -> MME; 3GPP TS 36.413) indicating that a temporary QCI1 bearer is admitted successfully in case that the bearer was only temporarily setup due to an overbooking done by the transport admission control (TAC).

Performance Aspects

New counters

Feature LTE2832 introduced 6 new counters

Counter name	Description
ERAB_REL_TEMP_QCI1 (M8006C301) #LTE EPS Bearer	This measurement provides the number of temporary QCI1 bearer release due to an overbooking timer expiry. Trigger event: This counter will be incremented on transmission of an S1AP: E-RAB RELEASE INDICATION message (eNB -> MME; 3GPP TS 36.413) due to an overbooking timer expiry for a temporarily admitted QCI1 bearer.

Performance Aspects

New counters

Feature LTE2832 introduced 6 new counters

Counter name	Description
ISYS_HO_SRVCC_OVB_ATT (M8016C58) #LTE Inter System Handover	This measurement provides the number of Inter-System Handover attempts to WCDMA with the SRVCC (Single Radio Voice Call Continuity, 3GPP TS 23.216) of a temporarily admitted QCI1 bearer due to an overbooking. Trigger event: This counter will be incremented on the reception of an S1AP: HANDOVER COMMAND message (source eNB <- MME; 3GPP TS 36.413) in case that this message is received in response to the preparation of an Inter-System Handover to WCDMA with the SRVCC (Single Radio Voice Call Continuity, 3GPP TS 23.216) of a temporarily admitted QCI1 bearer due to an overbooking.

Performance Aspects

New counters

Feature LTE2832 introduced 6 new counters

Counter name	Description
ISYS_HO_SRVCC_OVB_SUCC (M8016C59) #LTE Inter System Handover	This measurement provides the number of successful Inter-System Handover to WCDMA with the SRVCC (Single Radio Voice Call Continuity, 3GPP TS 23.216) of a temporarily admitted QCI1 bearer due to an overbooking. Trigger event: This counter will be incremented on the reception of an S1AP:UE CONTEXT RELEASE COMMAND message (source eNB <- MME; 3GPP TS 36.413) with Cause value "Radio Network Layer (Successful Handover)" in case that this message is received for an Inter-System Handover to WCDMA with the SRVCC (Single Radio Voice Call Continuity, 3GPP TS 23.216) of a temporarily admitted QCI1 bearer due to an overbooking.

Performance Aspects

New counters

Feature LTE2832 introduced 6 new counters

Counter name	Description
ISYS_HO_SRVCC_OVB_FAIL (M8016C60) #LTE Inter System Handover	This measurement provides the number of failed attempts of Inter-System Handover to WCDMA with the SRVCC (Single Radio Voice Call Continuity, 3GPP TS 23.216) of a temporarily admitted QCI1 bearer due to an overbooking. Trigger event: This counter will be incremented due to the expiration of the guarding timer TS1RELOCoverall (3GPP TS 36.413) in case that this timer was started because of an Inter-System Handover to WCDMA with the SRVCC (Single Radio Voice Call Continuity, 3GPP TS 23.216) of a temporarily admitted QCI1 bearer due to an overbooking.

Performance Aspects

Feature impact

Feature impact	How to measure?
SR for success E-RAB setup with QCI1 due to E-RAB Setup procedure Before activation of LTE2832 it is worth to identify areas where it is reasonable to use this feature. For this purposes following KPI (this is some proposal, not official KPI) may be used. The lower value of this KPI the more setup attempts for QCI1 bearers are rejected. Note that this KPI covers the cases for which bearers are requested by S1AP: E-RAB SETUP REQUEST only and excludes the cases for which bearer with QCI1 is requested by S1AP: INITIAL CONTEXT SETUP REQUEST or S1AP/X2AP:HANDOVER REQUEST. This is because LTE2832 logic allows for temporary establishment of QCI1 requested only by S1AP: E-RAB SETUP REQUEST.	KPIs: E-UTRAN E-RAB Setup Success Ratio, QCI1, due to E-RAB Setup procedure = (proposal) $\frac{\text{ERAB\_ADD\_SETUP\_SUCC\_QCI1}}{\text{ERAB\_ADD\_SETUP\_ATT\_QCI1}} \times 100$ Counters: ERAB_ADD_SETUP_ATT_QCI1 (M8006C197) This measurement provides the number of setup attempts of E-RABs with QCI1 requested by S1AP:E-RAB SETUP REQUEST ERAB_ADD_SETUP_SUCC_QCI1 (M8006C215) This measurement provides the number of successfully established E-RABs of QCI1 requested by S1AP:E-RAB SETUP REQUEST

Performance Aspects

Feature impact

Feature impact	How to measure?
Success Ratio for E-RAB setup with QCI1 might be improved (KPI LTE_5204c) This is caused by the fact that QCI1 bearer establishment that was previously rejected due to lack of AC resources now can be established.	KPIs: $\text{E-UTRAN E-RAB Setup Success Ratio, QCI1} = \frac{\text{ERAB\_INI\_SETUP\_SUCC\_QCI1} + \textbf{ERAB\_ADD\_SETUP\_SUCC\_QCI1} - \text{ERAB\_REL\_TEMP\_QCI1}}{\text{ERAB\_INI\_SETUP\_ATT\_QCI1} + \text{ERAB\_ADD\_SETUP\_ATT\_QCI1}} \times 100$ Counters: ERAB_INI_SETUP_ATT_QCI1 (M8006C188) This measurement provides the number of setup attempts of E-RABs with QCI1 requested by S1AP:INITIAL CONTEXT SETUP REQUEST ERAB_ADD_SETUP_ATT_QCI1 (M8006C197) This measurement provides the number of setup attempts of E-RABs with QCI1 requested by S1AP:E-RAB SETUP REQUEST ERAB_INI_SETUP_SUCC_QCI1(M8006C206) This measurement provides the number of successfully established E-RABs of QCI1 requested by S1AP:INITIAL CONTEXT SETUP REQUEST ERAB_ADD_SETUP_SUCC_QCI1 (M8006C215) This measurement provides the number of successfully established E-RABs of QCI1 requested by S1AP:E-RAB SETUP REQUEST ERAB_REL_TEMP_QCI1 (M8006C301) This measurement provides the number of temporary QCI1 bearer release due to an overbooking timer expiry


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