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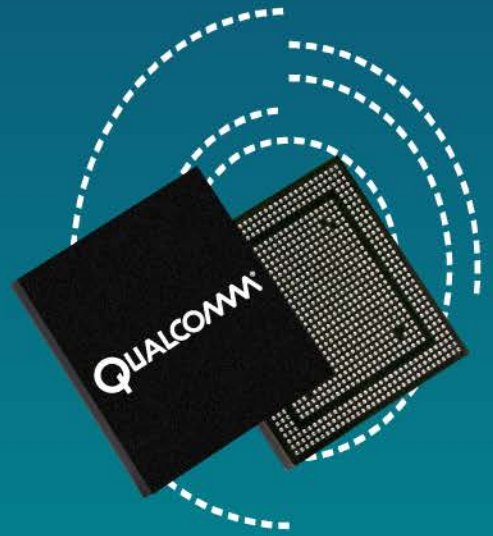

MPSS.BO.2.x Concurrent RAT 1xSRLTE/1xSLTE Overview

80-NN093-1 C

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Revision History

Revision	Date	Description
A	Apr 2014	Initial release
B	May 2014	Corrected NV settings
C	Jun 2014	Updated log analysis and NV configuration details

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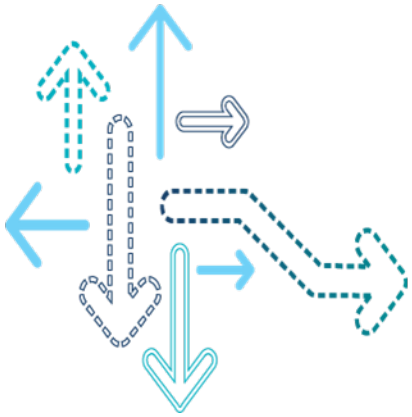
1xSRLTE

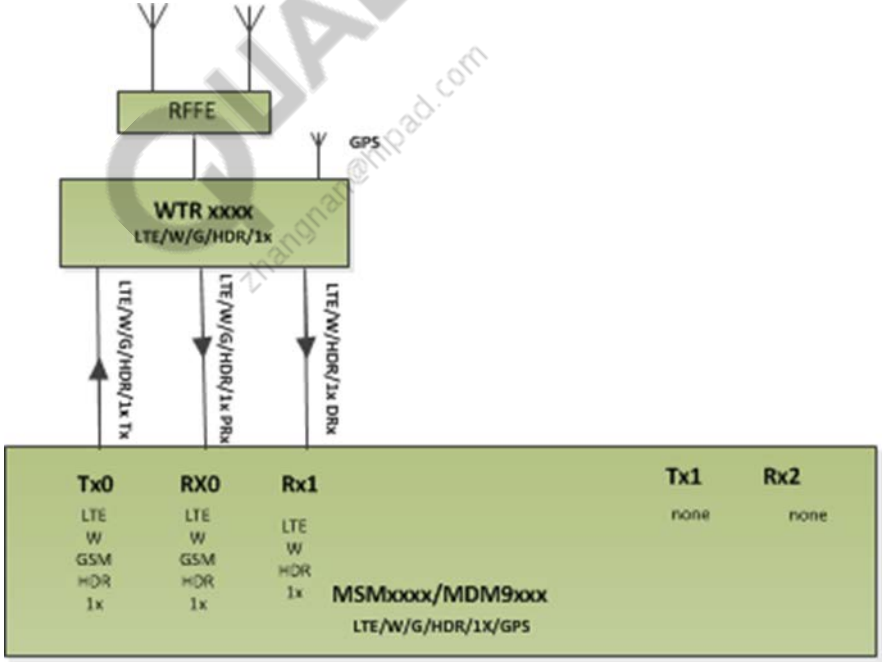


Overview

- Concept
  - Hybrid tuneaway design between LTE and 1X systems
  - 1X Shared Primary Receive with LTE (1xSPRx-LTE)
  - Enable only 1X voice or LTE data at a given time
- Motivation
  - To save battery power and cost of second transceiver and associated circuitry
- Limitation
  - Cannot support simultaneous voice (1X) and data (LTE) operation, i.e., SVLTE

Block Diagram – No LTE CA

- 2 Rx/1 Tx
- 1X/LTE shares the same primary/diversity Rx/Tx chain
- Focus on Hybrid mode



Operation

- UE capability – 1X, EV-DO, and LTE
- LTE coverage
  - UE operates in 1xSRTE mode
  - Leverages 1X for CS voice and LTE for PS data
- No LTE coverage
  - UE operates in 1X/HDR Hybrid or SHDR mode
  - 1X for CS voice and HDR for PS data
- IRAT and data services requirements are compliant when UE transits between 1xSRLTE, 3G, and 1X-Only modes

Modes of Operation

- Operation mode configuration (Policy Manager)
  - CSFB Preferred
- Initial mode determination (only if CSFB Preferred mode is configured)
  - UE is in CSFB mode (LTE in main stack)
  - Determine the operation mode upon initial attach
    - 1xSRLTE mode if:
      - CSFB, 1xCSFB, and VoLTE services are not supported on LTE
      - 1xSRLTE operation is possible in the current LTE PLMN based on the Policy Manager configuration

Modes of Operation (cont.)

- Dynamic mode switch
  - 1xSRLTE→1xCSFB
    - Cell change and SIB8 indicated 1xCSFB support
  - 1xCSFB→1xSRLTE
    - Cell change and 1xCSFB no longer supported, or
    - Preregistration fails or 1X long-term failure
  - No detach request to NAS for mode switch
- Domain selection
  - If VoLTE is *not* supported, check if MCC supports 1xSRLTE
  - If 1xSRLTE *is* supported, start 1X and LTE in parallel and enter 1xSRLTE mode; start $T_{returntoCSFB}$
  - If 1xSRLTE is *not* supported, continue the current domain selection logic

Policy Manager

- An .xml file is written to EFS on the device as /policyman/carrier_policy.xml.
- This file describes a set of rules to be applied in order to implement a specific feature.
- User must load the Policy Manager files required to exercise the correct UE mode for 1xSRLTE operation.
- The UE will not transition into 1xSRLTE mode unless the PLMN ID it is camped on to is populated in the PLMNID Whitelist in the Policy Manager file in question.

Policy Manager Files for 1xSRLTE

- In MPSS build releases, the Policy Manager .xml files can be found at: <MPSS Build Path>modem_proc\mmcp\policyman\configurations\1xSRLTE\test\csfb-pref\
  1. Go to the EFS explorer on the device and under root create a folder named policyman.
  2. Copy the carrier_policy.xml file into the policyman folder.
  3. Power cycle the device.
- The most common PLMN IDs in use are already populated in the files at the locations above.
- These .xml files can be modified if needed to include the PLMN ID that is being used in the setup or network in question (indicated in the next slide).

Policy Manager Files for 1xSRLTE (cont.)

- The following example shows three PLMN IDs.

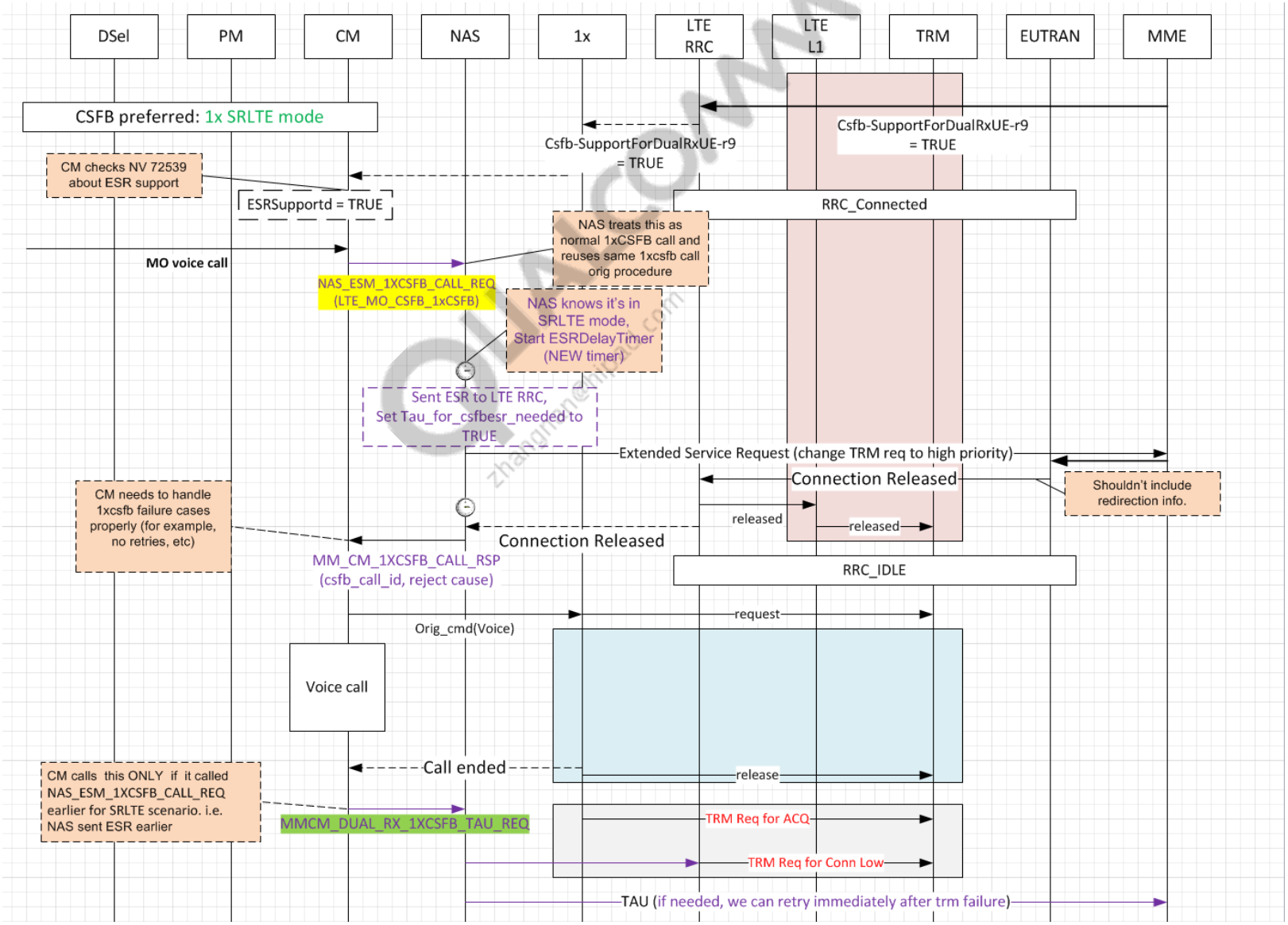
```
---------------------------------------------------------------------------------------------
<!-- These are the serving system PLMNs for which SXLTE will be allowed-->
<!-- NOTE: Proper functioning of the SXLTE policy requires that there be an PLMN list named "sxlte_plmns". Do NOT rename this list.-->
<plmn_list name = "sxlte_plmns">
001-01 330-01 374-01
</plmn_list>
---------------------------------------------------------------------------- -------------------------
```

- The Policy Manager .xml file in modem_proc\mmcp\policyman\configurations\1xSRLTE\test\csfb-pref is the default file for commercial use.

ESR Procedure-Based Calls

- Call processing if ESR supported (ESRsupported = TRUE)
  - 1xSRLTE supported
    - If in SIB8, csfb-SupportForDualRxUEs-r9 set to TRUE, or
    - NV 72539 indicates 1xSRLTE is supported
  - MO voice call – Trigger ESR procedure
  - MT voice call – Trigger ESR procedure before 1xCP sends page response
  - Call end process – Trigger TAU procedure (NAS)
- Call processing if ESR *not* supported (ESRsupported = FALSE)
  - Suspend LTE stack and perform 1X dedicated mode of operation

1xSRLTE Mode – 1X MO Voice (ESR Supported)



Mode Switch from CSFB to SRLTE Log Analysis

search string: OTA LOG|0x12E8|0xB0C0|0xB0E2|0xB0E3|0xB0EC|0xB0ED|srch state|rrc state|acq_cdma|acq_gwl|ue_mode=|switching|ESR timer|ESM_1xCSFB|Transitioned from|CON_RELEASE|TAU_REQ|IRAT_LTE_TO_1X

Mode switch - CSFB to SRLTE

//UE is set to CSFB pref mode of operation

MSG [00005/02] Call Manager/High cmpmprx.c 01953 =CM= PMPRX -> CM: Policyman ue_mode=7

//LTE is granted chain for Acq

LOG [0x12E8] Transceiver Resource Manager TRM 14 Request Immediate (Granted Chain 0)
Client Log ID = 14 (LTE)
Reason = 9 (Acquisition)
Priority = 85
Chain = 0 (Chain 0)
Granted = 1 (Chain 0)

//Secondary chain for Div

LOG [0x12E8] Transceiver Resource Manager TRM 15 Request Immediate (Granted Chain 1)
Client Log ID = 15 (LTE Secondary)
Reason = 11 (Diversity)
Priority = 50
Chain = 1 (Chain 1)
Granted = 2 (Chain 1)

//LTE is in idle camped state

EVENT [01606] EVENT_LTE_RRC_STATE_CHANGE RRC State = Idle Not Camped
EVENT [01606] EVENT_LTE_RRC_STATE_CHANGE RRC State = Idle Camped

Mode Switch from CSFB to SRLTE Log Analysis (cont.)

//LTE is checking SIB8 for 1x CSFB support, which was set to false, hence No 1xCSFB operation

MSG [09501/02/24]LTE RRC/High/IRAT lte_rrc_irat_to_1x_mgr.c 01675 IRAT_LTE_TO_1X : Preparing to send LTE_RRC_1X_SIB8_INFO_IND to 1xCP

MSG [09501/02/24]LTE RRC/High/IRAT lte_rrc_irat_to_1x_mgr.c 01645 IRAT_LTE_TO_1X : SIB8 does not have CSFB 1xRTT Registration Params!

//LTE is trying to check for CS registration

0xB0ED LTE NAS EMM Plain OTA Outgoing Message -- Attach request Msg

prot_disc = 7 (0x7) (EPS mobility management messages)

msg_type = 65 (0x41) (Attach request)

att_type = 2 (0x2) (combined EPS/IMSI attach)

msg_type = 208 (0xd0) (PDN connectivity request)

pdn_connectivity_req

pdn_type = 1 (0x1) (Ipv4)

req_type = 1 (0x1) (initial request)

voice_domain_pref_incl = 1 (0x1)

voice_domain_pref

length = 1 (0x1)

UE_usage_setting = 0 (0x0) (Voice centric)

voice_domain_pref_for_EUTRAN = 0 (0x0) (CS Vocie only)

EVENT [01606] EVENT_LTE_RRC_STATE_CHANGE RRC State = Connecting

EVENT [01606] EVENT_LTE_RRC_STATE_CHANGE RRC State = Connected

Mode Switch from CSFB to SRLTE Log Analysis (cont.)

//CS domain not available

LOG [0xB0EC] LTE NAS EMM Plain OTA Incoming Message Length: 0080
prot_disc = 7 (0x7) (EPS mobility management messages)
msg_type = 66 (0x42) (Attach accept)
emm_cause_incl = 1 (0x1)
emm_cause
cause_value = 18 (0x12) (CS domain not available)

//UE is switching to SRLTE mode

MSG [00005/02] Call Manager/High cmsoa.c 00716 =CM= CMSOA: Switching CSFB -> SRLTE
MSG [00005/02] Call Manager/High cmmsc.c 04193 =CM= MSC: info asubs_id=0, PM ue_mode=7, route_tbl id=0

//LTE is suspended for a moment

EVENT [01606] EVENT_LTE_RRC_STATE_CHANGE RRC State = Closing
EVENT [01606] EVENT_LTE_RRC_STATE_CHANGE RRC State = Idle Not Camped
EVENT [01606] EVENT_LTE_RRC_STATE_CHANGE RRC State = Inactive

MSG [00015/02] CDMA System Determination/High sdss.c 18653 =SD= ACQ_CDMA, band=0, chan=40, blksys=6
MSG [01007/02] Searcher/High srch.c 04208 Srch State (Inactive) -> (CDMA)

//1x Acquisition

LOG [0x12E8] Transceiver Resource Manager TRM 1x Grant Use (Granted Chain 0)
Lock State = 5 (Locked Until)
Resource = 9 (Rx Best Possible 2)
Reason = 9 (Acquisition)
Priority = 100
Chain = 7 (Best Possible Chain 2)
Granted = 1 (Chain 0)

Mode Switch from CSFB to SRLTE Log Analysis (cont.)

MSG [01007/02] Searcher/High 02:48:38.980 srch.c 04208 Srch State (Acq) -> (Sync)
OTA LOG [0x1006/001]Sync/Sync 00:00:37.496 Length: 0028
MSG [01007/02] Searcher/High 02:48:39.489 srch.c 04208 Srch State (Sync) -> (Slew)
MSG [01007/02] Searcher/High 02:48:39.653 srch.c 04208 Srch State (Slew) -> (Paging)

LOG [0x12E8] Transceiver Resource Manager 02:48:40.927 TRM 1x Reserve Lock (Released Chain 0)
Lock State = 1 (Reserved At)
Resource = 0 (Rx Any)
Reason = 5 (Demod Page)
Priority = 185

EVENT [01606] EVENT_LTE_RRC_STATE_CHANGE RRC State = Connected

\\LTE releasing chain
LOG [0x12E8] Transceiver Resource Manager TRM 14 Release (Released Chain 0)
LOG [0x12E8] Transceiver Resource Manager TRM 15 Release (Released Chain 1)

\\Demod request - Chain 0 is granted since device is operating in SRLTE mode
LOG [0x12E8] Transceiver Resource Manager TRM 1x Request Immediate (Granted Chain 0)

\\After QPCH demod, chain is released.
LOG [0x12E8] Transceiver Resource Manager TRM 1x Reserve Lock (Released Chain 0)

1xSRLTE Mode – 1X MO Voice (ESR Supported) Log Analysis

MO call Origination call flow

\\CM sending MO CS Call orig request to NAS

MSG [00099/02] Policy Manager/High 03:08:33.271 policyman_call_events.c 00125 received cm call evt 0

MSG [00005/02] Call Manager/High 03:08:33.272 cmcall.c 06622 =CM= cmcall_orig_proc start

MSG [00005/01] Call Manager/Medium 03:08:33.272 cmcsfbcall.c 00313 =CM= SEND: NAS_ESM_1XCSFB_CALL_REQ

MSG [03011/02/03/04]NAS SM/High/Error/Fatal 03:08:33.273 esm_utils.c 04324 ds1ESM: ESM sent NAS_EMM_1XCSFB_ESR_CALL_REQ

LOG [0xB0ED] LTE NAS EMM Plain OTA Outgoing Message03:08:33.275 Length: 0023

prot_disc = 7 (0x7) (EPS mobility management messages)

msg_type = 76 (0x4c) (Extended service request)

service_type = 0 (0x0) (mobile originating CS fallback)

\\ESR timer is started to receive Connection release from UE

MSG [03007/02/03/04]NAS MM/High/Error/Fatal emm_service_request_lib.c 01787 ds1=EMM= SRLTE ESR timer has been started for 1X SRLTE

\\LTE is in connected state

MSG [09501/02/11]LTE RRC/High/CTRL lte_rrc_controller.c 04138 RRCC: Transitioned from state IDLE_CAMPED to CONNECTING

MSG [09501/02/11]LTE RRC/High/CTRL lte_rrc_controller.c 04222 RRCC: Transitioned from state CONNECTING to CONNECTED

1xSRLTE Mode – 1X MO Voice (ESR Supported) Log Analysis (cont.)

If network responds with Connection release:

==========

\\eUTRA is sending connection release before ESR timer expiry

0xB0C0 LTE RRC OTA Packet -- DL_DCCH / RRCConnectionRelease

message c1 : rrcConnectionRelease :

criticalExtensions c1 : rrcConnectionRelease-r8 :

releaseCause other

MSG [09501/02/11]LTE RRC/High/CTRL lte_rrc_controller.c 04771 RRCC: Transitioned from state CONNECTED to CLOSING

MSG [09501/02/15]LTE RRC/High/LLC lte_rrc_llc.c 01315 Sent LTE_CPHY_CON_RELEASE_REQ

MSG [09501/02/15]LTE RRC/High/LLC lte_rrc_llc.c 03368 LTE_CPHY_CON_RELEASE_CNF received with success

Else ESR timer will expire:

==========

\\ESR timer expired, sending connection abort to RRC

MSG [03007/02/03/04]NAS MM/High/Error/Fatal emm_service_request_lib.c 01870 ds1=EMM= SRLTE ESR timer expired, sending abort connection to RRC

MSG [09501/02/11]LTE RRC/High/CTRL lte_rrc_controller.c 04704 RRCC: Transitioned from state CONNECTED to CLOSING

\\Connection release confirmation from RRC, UE is moving to 1x system for MO call, ESR timer is stopped

MSG [09501/02/15]LTE RRC/High/LLC lte_rrc_llc.c 01315 Sent LTE_CPHY_CON_RELEASE_REQ

MSG [09509/01/10]LTE ML1/Medium/Manager lte_ml1_mgr_cphy_cnf_handlers.c 01794 LTE_CPHY_CON_RELEASE_CNF Status: 0

MSG [09501/02/15]LTE RRC/High/LLC lte_rrc_llc.c 03368 LTE_CPHY_CON_RELEASE_CNF received with success

1xSRLTE Mode – 1X MO Voice (ESR Supported) Log Analysis (cont.)

MSG [03007/02/03/04]NAS MM/High/Error/Fatal emm_service_request_lib.c 00857 ds1=EMM= Aborting service request for 1X CSFB. SRLTE ESR timer is stopped

MSG [03007/02/03/04]NAS MM/High/Error/Fatal emm_esm_handler.c 02099 ds1=EMM= Sent NAS_ESM_1XCSFB_ESR_CALL_RSP

MSG [09501/02/11]LTE RRC/High/CTRL lte_rrc_controller.c 03866 RRCC: Transitioned from state CLOSING to IDLE_NOT_CAMPED

MSG [09501/02/11]LTE RRC/High/CTRL lte_rrc_controller.c 04060 RRCC: Transitioned from state IDLE_NOT_CAMPED to IDLE_CAMPED

\\1x was granted chain 0

LOG [0x12E8] Transceiver Resource Manager TRM 1x Request Immediate (Granted Chain 0)

\\Call origination sent to 1x BS

OTA LOG [0x1004/004 Access/Origination Length: 0045

OTA LOG [0x1007/021]Page/Extended Channel Assignment Length: 0030

\\UE is entering into 1x traffic

MSG [01007/02] Searcher/High srch.c 04208 Srch State (Access) -> (Paging)

MSG [01007/02] Searcher/High srch.c 04208 Srch State (Paging) -> (Traffic)

\\1x is retaining RF chains for Traffic state

LOG [0x12E8] Transceiver Resource Manager TRM 1x Change Priority

LOG [0x12E8] Transceiver Resource Manager TRM 1x Retain Lock

…….

\\Call release from UE.

OTA LOG [0x1005/001]Reverse/Order Length: 0007

OTA LOG [0x1008/001]Forward/Order Length: 0008

MSG [01007/02] Searcher/High srch.c 04208 Srch State (Traffic) -> (CDMA)

MSG [01006/01] Multiplex Sublayer/Medium rxctraffic.c 06724 Got RXC_RELEASE_F

MSG [01006/01] Multiplex Sublayer/Medium txctraffic.c 08741 Got TXC_RELEASE_F

1xSRLTE Mode – 1X MO Voice (ESR Supported) Log Analysis (cont.)

\\CM is sending TAU req, since NAS_ESM_1XCSFB_CALL_REQ was sent

MSG [00005/02] Call Manager/High cmcsfbcall.c 01322 =CM= Send MMCM_DUAL_RX_1XCSFB_TAU_REQ to MM

MSG [00005/02] Call Manager/High cmlog.c 03023 =CM= EVENT_CM_CALL_EVENT_END_2 - asubid 0

\\LTE is granted chain

LOG [0x12E8] Transceiver Resource Manager TRM 14 Grant Use (Granted Chain 0)

LOG [0x12E8] Transceiver Resource Manager TRM 15 Grant Use (Granted Chain 1)

\\TAU was sent

0xB0ED LTE NAS EMM Plain OTA Outgoing Message -- Tracking area update request Msg

UE_usage_setting = 0 (0x0) (Voice centric)

voice_domain_pref_for_EUTRAN = 0 (0x0) (CS Vocie only)

0xB0EC LTE NAS EMM Plain OTA Incoming Message -- Tracking area update accept Msg

msg_type = 73 (0x49) (Tracking area update accept)

eps_update_result = 0 (0x0) (TA updated)

MSG [03007/02/03/04]NAS MM/High/Error/Fatal emm_update_lib.c 06911 ds1=EMM= Received TAU Accept message

MSG [03007/02/03/04]NAS MM/High/Error/Fatal emm_update_lib.c 06913 ds1=EMM= T3430 has been stopped

...

\\UE is acquiring back 1x channel

MSG [00015/02] CDMA System Determination/High sdss.c 18653 =SD= ACQ_CDMA, band=0, chan=40, blksys=6

LOG [0x12E8] Transceiver Resource Manager TRM 1x Grant Use (Granted Chain 0)

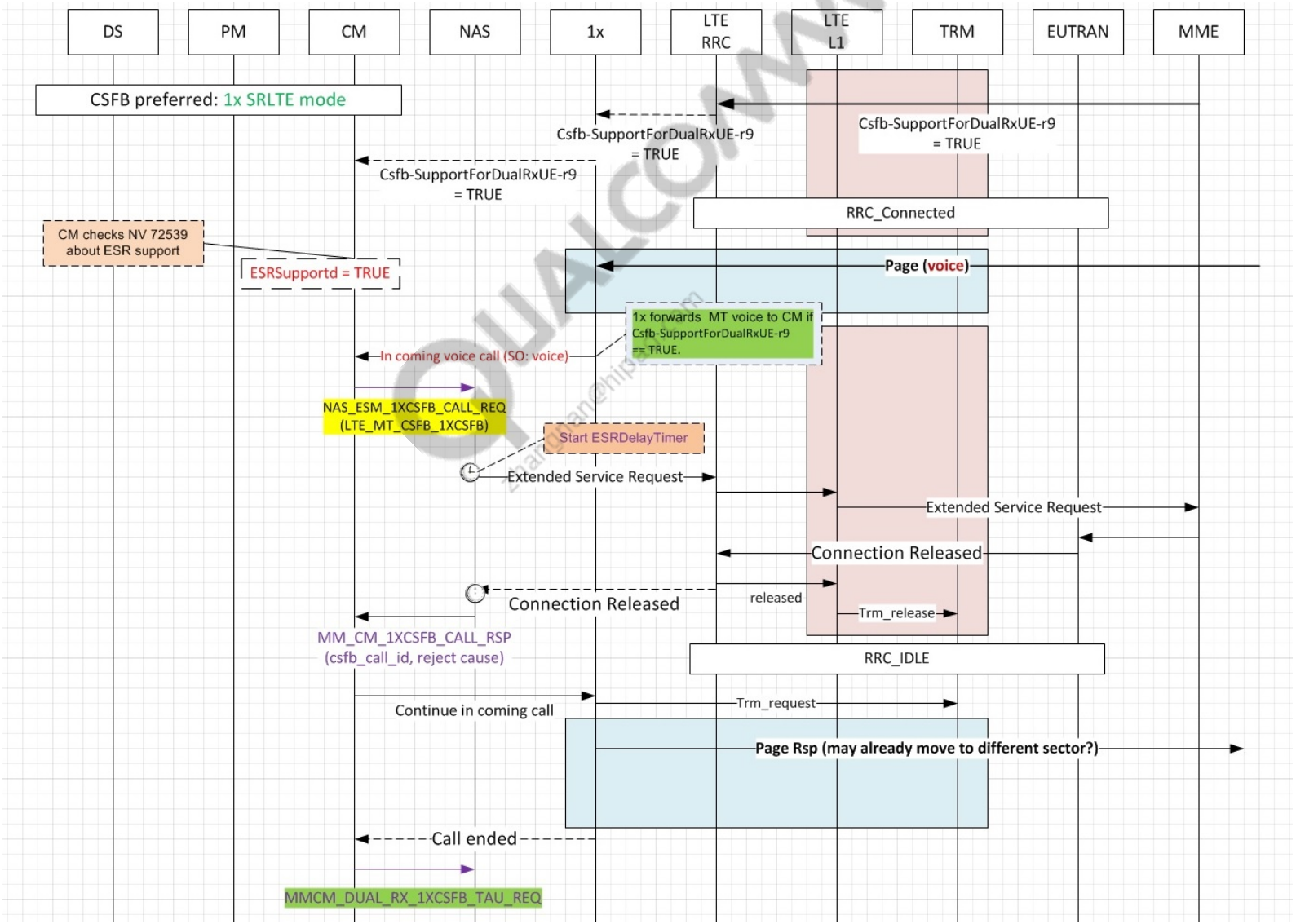
MSG [01007/02] Searcher/High srch.c 04208 Srch State (CDMA) -> (Acq)

MSG [01007/02] Searcher/High srch.c 04208 Srch State (Acq) -> (Sync)

MSG [01007/02] Searcher/High srch.c 04208 Srch State (Sync) -> (Slew)

MSG [01007/02] Searcher/High srch.c 04208 Srch State (Slew) -> (Paging)

1xSRLTE Mode – 1X MT Voice (ESR Supported)



1xSRLTE Mode – 1X MT Voice (ESR Supported) Log Analysis

\\MT page received

OTA LOG [0x1007/017]Page/General Page 15:10:06.221 Length: 0016
service_option = 3 (0x3) (EVRC 8K Voice)

\\CM is sending call request to NAS

MSG [00005/01] Call Manager/Medium cmcsfbcall.c 00364 =CM= SEND: NAS_ESM_1XCSFB_CALL_REQ

\\ESR sent by NAS

0xB0ED LTE NAS EMM Plain OTA Outgoing Message -- Extended service request Msg
prot_disc = 7 (0x7) (EPS mobility management messages)
msg_type = 76 (0x4c) (Extended service request)
service_type = 1 (0x1) (mobile terminating CS fallback)
csfb_response = 1 (0x1) (CS fallback accepted by the UE)

\\ESR timer has started.

MSG [03007/02/03/04]NAS MM/High/Error/Fatal emm_service_request_lib.c 01787 ds1=EMM= SRLTE ESR timer has been started for 1X SRLTE

MSG [09501/02/11]LTE RRC/High/CTRL lte_rrc_controller.c 04205 RRCC: Transitioned from state IDLE_CAMPED to CONNECTING

MSG [09501/02/11]LTE RRC/High/CTRL lte_rrc_controller.c 04289 RRCC: Transitioned from state CONNECTING to CONNECTED

\\eUTRA is sending connection release before timer expiry

0xB0C0 LTE RRC OTA Packet -- DL_DCCH / RRCConnectionRelease
message c1 : rrcConnectionRelease :
criticalExtensions c1 : rrcConnectionRelease-r8 :
releaseCause other

1xSRLTE Mode – 1X MT Voice (ESR Supported) Log Analysis (cont.)

MSG [09501/02/11]LTE RRC/High/CTRL lte_rrc_controller.c 04771 RRCC: Transitioned from state CONNECTED to CLOSING

MSG [09501/02/15]LTE RRC/High/LLC lte_rrc_llc.c 01315 Sent LTE_CPHY_CON_RELEASE_REQ

MSG [09501/02/15]LTE RRC/High/LLC lte_rrc_llc.c 03368 LTE_CPHY_CON_RELEASE_CNF received with success

\\LTE state change

MSG [09501/02/11]LTE RRC/High/CTRL 15:10:06.421 lte_rrc_controller.c 03933 RRCC: Transitioned from state CLOSING to IDLE_NOT_CAMPED

MSG [03007/02/03/04]NAS MM/High/Error/Fatal 15:10:06.422 emm_service_request_lib.c 00857 ds1=EMM= Aborting service request for 1X CSFB. SRLTE ESR timer is stopped

MSG [03007/02/03/04]NAS MM/High/Error/Fatal 15:10:06.423 emm_esm_handler.c 02099 ds1=EMM= Sent NAS_ESM_1XCSFB_ESR_CALL_RSP

\\LTE is in idle camped state

MSG [09501/02/11]LTE RRC/High/CTRL 15:10:06.433 lte_rrc_controller.c 04127 RRCC: Transitioned from state IDLE_NOT_CAMPED to IDLE_CAMPED

LOG [0x12E8] Transceiver Resource Manager 15:10:06.462 TRM 14 Reserve Lock (Released Chain 0)

LOG [0x12E8] Transceiver Resource Manager 15:10:06.462 TRM 15 Reserve Lock (Released Chain 1)

\\1x received chain for Access

LOG [0x12E8] Transceiver Resource Manager 15:10:06.462 TRM 1x Grant Use (Granted Chain 0)

MSG [01007/02] Searcher/High srch.c 04208 Srch State (Paging) -> (Access)

\\1x sending page response

OTA LOG [0x1004/005]Access/Page Response Length: 0039

msg_type = 5 (0x5) (Page Response)

service_option = 3 (0x3) (EVRC 8K Voice)

1xSRLTE Mode – 1X MT Voice (ESR Supported) Log Analysis (cont.)

OTA LOG [0x1007/046]Page/Extended Channel Assignment Length: 0035
msg_id = 46 (0x2e) (MEID Ext Channel Assignment)
assign_mode = 4 (0x4) (Enhanced Traffic Channel Assignment)

\\1x is holding chain for Traffic and UE is in traffic state.
MSG [01007/02] Searcher/High srch.c 04208 Srch State (Access) -> (Paging)
MSG [01007/02] Searcher/High srch.c 04208 Srch State (Paging) -> (Traffic)

…..

\\Call release
MSG [00005/02] Call Manager/High 15:11:09.328 cmxcall.c 07862 =CM= CallEnd state=3 status=29
MSG [01006/01] Multiplex Sublayer/Medium 15:11:09.328 txctraffic.c 08684 Got TXC_RELEASE_SO_F
MSG [01006/01] Multiplex Sublayer/Medium 15:11:09.328 rxctraffic.c 06699 Got RXC_RELEASE_SO_F

\\TAU request is sent to NAS
MSG [00005/02] Call Manager/High cmcsfbcall.c 01322 =CM= Send MMCM_DUAL_RX_1XCSFB_TAU_REQ to MM

\\1x Release order to network
OTA LOG [0x1005/001]Reverse/Order Length: 0007
order = 21 (0x15) (Release Order Normal/Power Down/Service Inactive Ind/Reduced SCI)
ordq_incl = 0 (0x0)
OTA LOG [0x1008/001]Forward/Order Length: 0008
order = 21 (0x15) (Release - No Reason/SO rejected Order)
MSG [01007/02] Searcher/High srch.c 04208 Srch State (Traffic) -> (CDMA)
MSG [09501/02/11]LTE RRC/High/CTRL lte_rrc_controller.c 04127 RRCC: Transitioned from state IDLE_NOT_CAMPED to IDLE_CAMPED

1xSRLTE Mode – 1X MT Voice (ESR Supported) Log Analysis (cont.)

\\TAU req and accept

0xB0ED LTE NAS EMM Plain OTA Outgoing Message -- Tracking area update request Msg

voice_domain_pref_incl = 1 (0x1)

voice_domain_pref

length = 1 (0x1)

UE_usage_setting = 0 (0x0) (Voice centric)

voice_domain_pref_for_EUTRAN = 0 (0x0) (CS Vocie only)

MSG [09501/02/11]LTE RRC/High/CTRL lte_rrc_controller.c 04205 RRCC: Transitioned from state IDLE_CAMPED to CONNECTING

MSG [09501/02/11]LTE RRC/High/CTRL lte_rrc_controller.c 04289 RRCC: Transitioned from state CONNECTING to CONNECTED

0xB0EC LTE NAS EMM Plain OTA Incoming Message -- Tracking area update accept Msg

\\1x Acq followed by 1x idle and LTE idle operation

MSG [09501/02/11]LTE RRC/High/CTRL lte_rrc_controller.c 04771 RRCC: Transitioned from state CONNECTED to CLOSING

MSG [01007/02] Searcher/High srch.c 04208 Srch State (CDMA) -> (Acq)

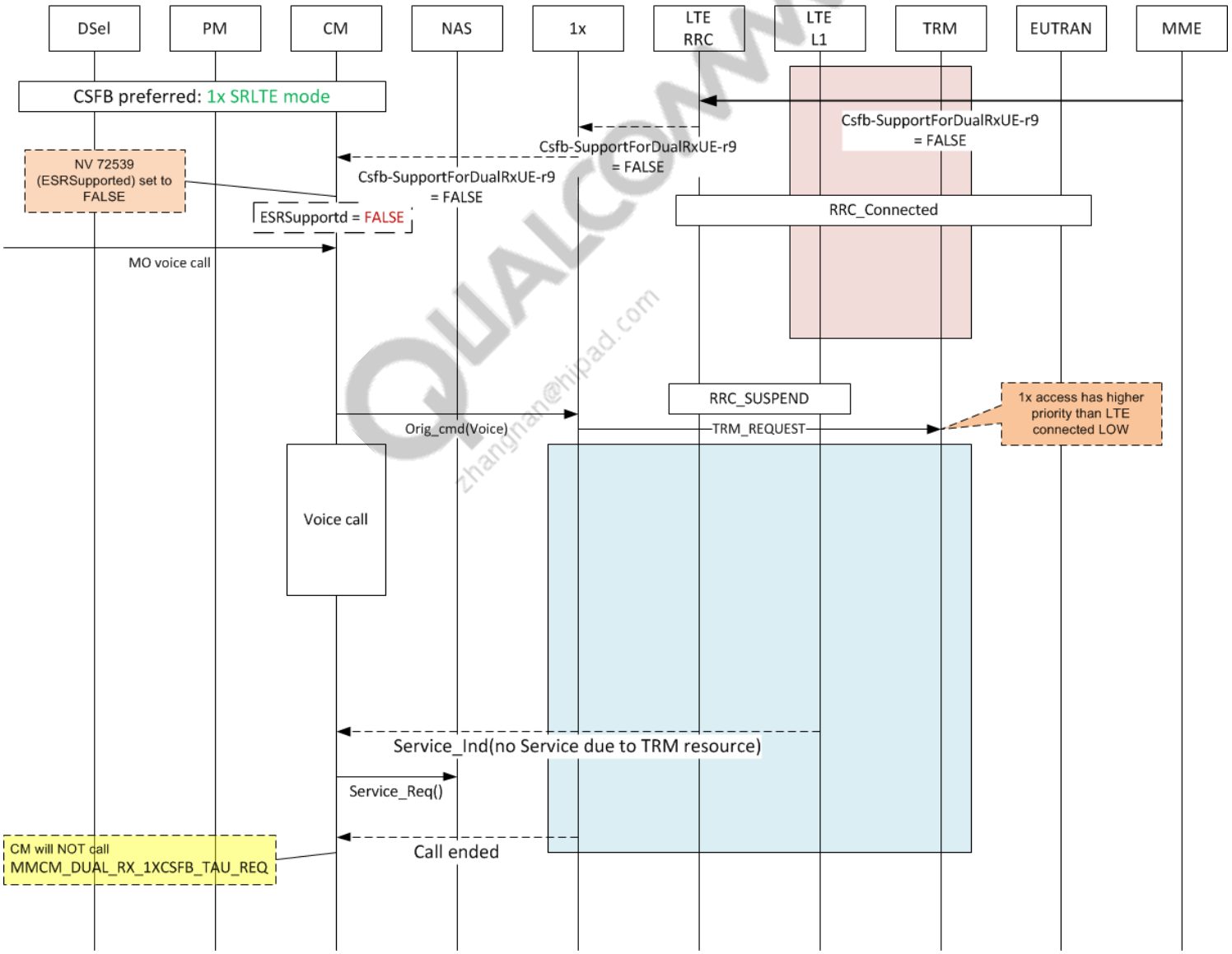
EVENT [01606] EVENT_LTE_RRC_STATE_CHANGE RRC State = Idle Not Camped

MSG [00005/02] Call Manager/High cmmsc.c 04363 =CM= MSC: info asubs_id=0, PM ue_mode=7, route_tbl id=0

MSG [01007/02] Searcher/High srch.c 04208 Srch State (Acq) -> (Sync)

EVENT [01606] EVENT_LTE_RRC_STATE_CHANGE RRC State = Idle Camped

1xSRLTE Mode – 1X MO Voice (ESR Not Supported)



Transceiver Resource Manager (TRM) Priority Radio Resource Conflict Management

1xSRLTE	1X Idle wake	1X Access	1X Traffic	1X Sleep	1X Acquisition
LTE Acquisition	Tx0 = None Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = None Rx0 = LTE Rx1 = LTE	Tx0 = None Rx0 = 1X/LTE Rx1 = None/LTE
LTE Sleep	Tx0 = None Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = None Rx0 = None Rx1 = None	Tx0 = None Rx0 = 1X Rx1 = None
LTE Access	Tx0 = None Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = LTE Rx0 = LTE Rx1 = LTE	Tx0 = LTE Rx0 = LTE Rx1 = LTE
LTE Idle wake-up	Tx0 = None Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = None Rx0 = LTE Rx1 = LTE	Tx0 = None Rx0 = LTE Rx1 = LTE
LTE Connected HI	Tx0 = LTE Rx0 = LTE Rx1 = LTE	Tx0 = LTE Rx0 = LTE Rx1 = LTE	Tx0 = NA Rx0 = NA Rx1 = NA	Tx0 = LTE Rx0 = LTE Rx1 = LTE	Tx0 = LTE Rx0 = LTE Rx1 = LTE
LTE Connected LO	Tx0 = None Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = LTE Rx0 = LTE Rx1 = LTE	Tx0 = None Rx0 = 1X Rx1 = None

Non-ESR Procedure-Based Operations

- 1xPCH idle operation
- 1xQPCH operation (both PI bits)
- SSD updated using non-CS voice paging SO
- Any type of 1X registration with BSC/network
- Location update (check for 1X)
- MO and MT SMS over access or traffic channel
- MS-directed pages with SOs
  - 0006H – SMS rate set 1
  - 000EH – SMS rate set 2
- Emergency calls

Emergency Call Requirements

- ESR shall not be enabled for emergency calls
- If 1X is in full service
  - Suspend all 1xSRLTE operation until emergency call ends
  - After emergency call ends, UE will acquire 1X first, followed by LTE, and then EV-DO
- If 1X is OoS
  - Search other RATs with CS capability
  - Suspend all 1xSRLTE operations until emergency call ends

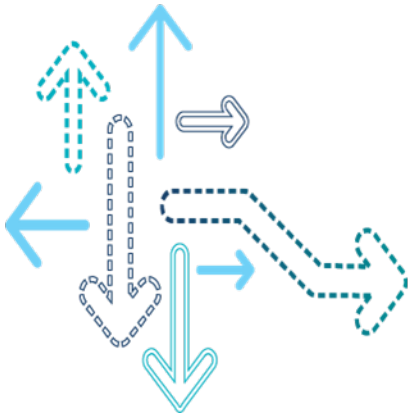
NV Configuration – General Provisioning

- UI settings
  - To set the mode preference, from the Home menu, select Settings→Wireless and Networks→mobile networks→Network mode→Global
  - To set the RTRE configuration, from the Home menu, select Settings→Wireless and Networks→mobile networks→CDMA Subscription→USIM
- TRM configuration for 1xSRLTE mode
  - NV 3446 – 2,0 (default)

NV Configuration – 1xSRLTE

NV item	Value	Description
179	0	Voice privacy – Set to disable
850	0x02	NV_SERVICE_DOMAIN_PREF(circuit-switched/packet-switched only)
3446	2, 0	TRM configuration for 1xSRLTE mode
3635	180,3,300	▪ Item[1] – BSR timer from eHRPD to LTE ▪ Item[16] – HDR hold timer ▪ Item[21] – BSR timer from HRPD to LTE
65777	0	Voice-centric device
65819	1	Item[1] – Scan LTE/EV-DO systems simultaneously with CDMA at power-up
66048	0	Voice domain pref – CS only
72539	1	ESR support/CSFB support for dual Rx UEs ▪ 1 – Supported ▪ 0 – Not supported
72550	500	LTE NAS 1xSRLTE ESR delay timer in msec

1xSLTE



Overview

- Allows LTE and 1X operation simultaneously
- LTE and 1X RAT share radio resources in LTE Active/1X Idle and LTE Idle/1X Idle states
- 1X Shared Diversity Receive with LTE (1x-SDRxLTE)
- LTE may also opportunistically use the diversity chain when 1X is in Idle, Access, or Acquisition state
- UE can support SLTE mode of operation in both LTE Single Carrier and LTE CA modes
- UE shall support legacy SHDR mode of operation (no LTE converge)
- Limitation
  - Monitoring 1X pages when LTE is in Connected state affects both uplink and downlink LTE throughput

Requirements

- Acquisition on 1X is not allowed on secondary chain
- When UE is camped on DO only, it shall:
  - Perform 1X OoS scans once every N_1x_throttle min to look for 1X service
  - Remain camped on DO only if it is associated with acquired 1X system
- No interfrequency or inter-RAT measurements for LTE when 1X is performing idle operations on the secondary chain
- Wake up the LTE stack early if a collision is detected between LTE wake-up and 1X wake-up time/idle operation

TRM Priority Radio Resource Conflict Management

1xSLTE	1X Idle wake	1X Access	1X Traffic	1X Sleep	1X Acquisition
LTE Acquisition	Tx0 = None Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = None Rx0 = LTE Rx1 = LTE	Tx0 = None Rx0 = LTE/1X Rx1 = 1X/LTE
LTE Sleep	Tx0 = None Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = None Rx0 = None Rx1 = None	Tx0 = None Rx0 = 1X Rx1 = None
LTE Access	Tx0 = LTE Rx0 = LTE Rx1 = 1X	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = LTE Rx0 = LTE Rx1 = LTE	Tx0 = LTE Rx0 = LTE Rx1 = LTE
LTE Idle wake-up	Tx0 = None Rx0 = LTE Rx1 = 1X	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = None Rx0 = LTE Rx1 = LTE	Tx0 = None Rx0 = LTE Rx1 = LTE
LTE Connected HI	Tx0 = LTE Rx0 = LTE Rx1 = LTE	Tx0 = LTE Rx0 = LTE Rx1 = LTE	Tx0 = NA Rx0 = NA Rx1 = NA	Tx0 = LTE Rx0 = LTE Rx1 = LTE	Tx0 = LTE Rx0 = LTE Rx1 = LTE
LTE Connected LO	Tx0 = LTE Rx0 = LTE Rx1 = 1X	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = 1X Rx0 = 1X Rx1 = None	Tx0 = LTE Rx0 = LTE Rx1 = LTE	Tx0 = None Rx0 = 1X Rx1 = None

1xSLTE Mode – LTE Idle Mode and 1x Idle Mode Log Analysis

//LTE is holding the chains and now its time for releasing the chain to 1x....

LOG [0x12E8] Transceiver Resource Manager TRM 14 Release (Released Chain 0)
Client Log ID = 14 (LTE)
Old State:
Lock State = 11 (Inv)
Resource = 5 (RxTx Best)
Reason = 35 (Reserved)
Priority = 95
Chain = 0 (Chain 0)
Granted = 1 (Chain 0)
Group = 0
Retain = 0
New State:
Lock State = 0 (Inactive)
Resource = 5 (RxTx Best)
Reason = 35 (Reserved)
Priority = 95
Chain = 4 (No Chain)
Granted = 0 (Denied)

LOG [0x12E8] Transceiver Resource Manager TRM 15 Release (Released Chain 1)
Client Log ID = 15 (LTE Secondary)
Old State:
Lock State = 11 (Inv)
Resource = 2 (Rx Secondary)
Reason = 11 (Diversity)
Priority = 50
Chain = 1 (Chain 1)
Granted = 2 (Chain 1)
Group = 1
Retain = 0
New State:
Lock State = 0 (Inactive)
Resource = 2 (Rx Secondary)
Reason = 11 (Diversity)
Priority = 50
Chain = 4 (No Chain)
Granted = 0 (Denied)

1xSLTE Mode – LTE Idle Mode and 1x Idle Mode Log Analysis (cont.)

//LTE was granted Chain 0 in SLTE mode of operation.

LOG [0x12E8] Transceiver Resource Manager TRM 14 Grant Use (Granted Chain 0)

Old State:
- Lock State = 3 (Request and Notify)
- Resource = 5 (RxTx Best)
- Reason = 35 (Reserved)
- Priority = 95
- Chain = 0 (Chain 0)
- Granted = 0 (Denied)

New State:
- Lock State = 5 (Locked Until)
- Resource = 5 (RxTx Best)
- Reason = 35 (Reserved)
- Priority = 95
- Chain = 0 (Chain 0)
- Granted = 1 (Chain 0)

//LTE secondary Chain 1 is denied, since 1x needs it for Demod.

LOG [0x12E8] Transceiver Resource Manager 14:36:22.156 TRM 15 Request And Notify

Old State:
- Lock State = 0 (Inactive)
- Resource = 2 (Rx Secondary)
- Reason = 11 (Diversity)
- Priority = 50
- Chain = 4 (No Chain)
- Granted = 0 (Denied)

New State:
- Lock State = 3 (Request and Notify)
- Resource = 2 (Rx Secondary)
- Reason = 11 (Diversity)
- Priority = 50
- Chain = 1 (Chain 1)
- Granted = 0 (Denied)

1xSLTE Mode – LTE Idle Mode and 1x Idle Mode Log Analysis (cont.)

//For 1x Chain 1 is granted since UE is operating in SLTE mode

LOG [0x12E8] Transceiver Resource Manager 14:36:22.163 TRM 1x Request Immediate (Granted Chain 1)

Client Log ID = 0 (1X)

Old State:

Lock State = 1 (Reserved At)

Resource = 0 (Rx Any)

Reason = 5 (Demod Page)

Priority = 185

Chain = 2 (Any Chain)

Granted = 0 (Denied)

Group = 1

Retain = 0

New State:

Lock State = 5 (Locked Until)

Resource = 0 (Rx Any)

Reason = 5 (Demod Page)

Priority = 185

Chain = 2 (Any Chain)

Granted = 2 (Chain 1)

NV/EFS Configuration – 1xSLTE

NV item	Value	Description
3446	2,64	TRM configuration for 1xSLTE mode

Note: All other NV items are same as for SRLTE.

References

Ref.	Document	
Qualcomm Technologies		
Q1	*Application Note: Software Glossary for Customers*	CL93-V3077-1
Q2	*CSFB to UTRAN/GERAN Feature Definition Document*	80-N1427-1
Q3	*1X Circuit-Switched Fallback Feature Definition Document*	80-N2167-1
Q4	*LTE Domain Selection In Multimode UEs Feature Definition Document*	80-N1425-1
Q5	*Global Simultaneous 1X Voice and LTE or DO Data (SVLTE/SV-DO) for MSM8960-Based Verizon Devices*	80-N7312-1
Q6	*Multimode System Selection Based on 3GPP2 Standard Feature Design Document*	80-VL064-1
Q7	*Redirection-Based Mobility from E-UTRA to cdma2000 Feature Definition Document*	80-VR259-1
Q8	*Presentation: Policy Manager Overview*	80-NJ017-14
Q9	*Application Note: Verizon bSRLTE/SLTE Device Configuration and Testing Information*	80-NP385-1

Questions?

https://support.cdmatech.com