LTE TOTALeNodeB Solution

User Guide (for 5.0 GA on Qualcomm FSM9955 TDD)

1222337 1.0

© 2017 by RadiSys Corporation. All rights reserved.

Radisys, Network Service-Ready Platform, Quick!Start, TAPA, Trillium, Trillium+plus, Trillium Digital Systems, Trillium On Board, TAPA, and the Trillium logo are trademarks or registered trademarks of RadiSys Corporation. All other trademarks, registered trademarks, service marks, and trade names are the property of their respective owners.

Contents

Figures

Tables

1 Preface

1.1 Objective

This User Guide provides the usage description of the LTE TOTALeNodeB solution designed by Radisys for Qualcomm FSM9955 Time Division Duplex (TDD) SoC. This document describes the procedure to build, setup, configure, and execute signaling and data calls.

1.2 Audience

Radisys assumes that the readers of this document are:

- Product Development team
- Product Line Management team
- Sales team
- Test or Validation team
- Program Management team
- Customers

The readers must have an understanding of LTE technology and eNodeB functionality.

1.3 Document Organization

This document contains the following sections.

Table-1: Document Organization

S.No.	Section	Description
1	Preface	Provides the objective and release details.
2	Introduction	Provides an overview of the product, including the product description and features.
3	TOTALeNodeB Test Setup	Describes the test setup information for this software.
4	Building Binaries	Describes the hardware, software requirements and procedure to build the integrated stack.
5	TOTALeNodeB Logging - Reporting Problems	Describes the different logging options and statistics.
6	Appendix – I	Lists the configuration parameters of TeNB.
7	Appendix – II	Provides details on traffic generators and TCP/UDP performance testing.
8	Appendix - III	Provides details about Logging
9	References	Lists the reference documents.

10	Definitions and Acronyms	Provides the acronyms and descriptions.

1.4 Release History

The following table lists the history of changes in successive revisions to this document.

Table-2: Release History

Version	Date	Authors	Description
1.0	Dec 15, 2016	Qualcomm TDD Integration Team	User Guide document of TOTALeNodeB 5.0 GA TDD Solution on Qualcomm FSM9955 platform.
0.3	Oct 15, 2016	Qualcomm TDD Integration Team	User Guide document of TOTALeNodeB 5.0 EA TDD Solution on Qualcomm FSM9955 platform.
0.2	Sep 15, 2016	Qualcomm TDD Integration Team	User Guide document of TOTALeNodeB Milestone-3 (MS3) TDD Solution on Qualcomm FSM9955 platform.
0.1	Aug 15, 2016	Qualcomm TDD Integration Team	Preliminary document of TOTALeNodeB Milestone-2 (MS2) TDD Solution on Qualcomm FSM9955 platforms.

2 Introduction

2.1 Product Description

Radisys TOTALeNodeB is an eNodeB solution targeted for small cells. TOTALeNodeB comprises control and data plane protocol suites towards UE and Core Network. TOTALeNodeB consists of functionalities of data application to exchange data from PDCP to eGTP-u, S1AP relay module responsible to relay NAS signaling messages between the UE and CN entities and X2AP relay module responsible for relaying control and message specific information between eNodeBs. TOTALeNodeB software provides all 3GPP compliant eNodeB protocols stacks integrated. The Software Architecture provides flexibility and configurability to distribute the protocol layers across multiple processor, multiple cores in a processor and multiple threads in a core.

For more details on the list of supported features, refer to [3] document.

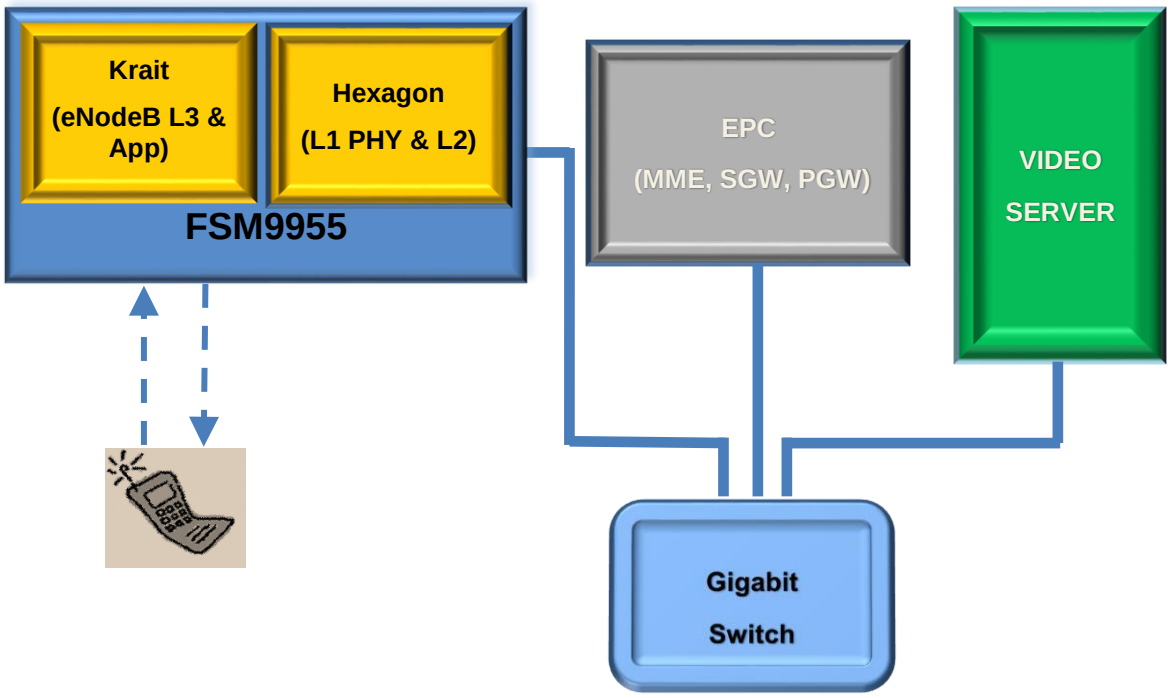
3 TOTALeNodeB Test Setup

This section describes the setup required for executing the eNodeB and EPC (binaries) in end-to-end environment to demonstrate the functions and interactions of EPC with rest of nodes such as UE, eNodeB, external client and server.

3.1 TOTALeNodeB End-to-End Demo on Qualcomm FSM9955

Figure-1 shows the test setup of end-to-end demo executing LTE eNodeB on Qualcomm FSM9955 board, commercial UE, and CNEs on Linux.

Figure-1: TOTALeNodeB End-to-End Demo on Qualcomm FSM9955 Board



3.2 Hardware and Software Requirements

This section provides the information of software and hardware used in TOTALeNodeB solution and how to configure and bring-up the test setup.

3.2.1 Hardware Requirements

Table-3 lists the hardware requirements for the TeNB test setup.

Table-3: Hardware Requirements

Hardware	Purpose
Linux Machine with an Ethernet Card	For EPC (Configure 2 additional virtual IPs apart from primary IP address to execute MME,SGW and PGW)
Desktop/Laptop with windows XP/Windows 7	For connecting UEs, If dongles are used
One board from Qualcomm (FSM9955)	To run eNodeB
One Laptop/Desktop with Windows/Linux	To execute video server
One 8-Port Gigabit Ethernet switch and 5-6 Ethernet cables	To connect all the machines (Like EPC,eNodeB,video server)
USB-to-Serial Adapters	To connect Qualcomm Krait console

3.2.2 Software Requirements

3.2.2.1 Qualcomm Software

Type of Board	QCOM TDD PHY (L1)	BSP
FSM9955	PP 6.7.1	PP 6.7.1

3.2.2.2 Radisys Components

LTE TOTALeNodeB binaries are generated as described in Chapter 4, Building Binaries.

1. With OAM, Binaries are available in the following path:
    a. L3 binary:BUILD_ROOT/fsm99xx_ltel2/app/rsys/build/rsys.
    b. L2 binary: BUILD_ROOT/LINUX/project/fsm9900_cdp-fapi/platform-fsm9900_cdp-fapi/build- target /lte-l2-1.0.0/_hexBuild/_fsm99xxCDP_1/_fsm9900_cdp/bin
2. Without OAM, Binaries are available in the following path:
    a. L3 binary:BUILD_ROOT/fsm99xx_ltel2/app/rsys/build/rsys_withoutoam.

b. L2 binary: BUILD_ROOT/LINUX/project/fsm9900_cdp-fapi/platform-fsm9900_cdp-fapi/build- target /lte-l2-1.0.0/_hexBuild/_fsm99xxCDP_1/_fsm9900_cdp/bin

3.2.2.3 General Software

1. Tftpboot server to burn BSP
2. arm-v7a-linux-gnueabi-gcc for compiling eNodeB binaries
3. hexagon compiler for compiling the hexagon image
4. putty/hercules_3-2-2 package for console/terminal access to the board

3.3 Hardware and Software Bring Up

3.3.1 Steps to Bring Up the Hardware

Perform the following steps for board bringup.

1. Setup a Linux build machine for compilation.
2. Connect the Qualcomm board in this network.
3. Connect board to desktop or laptop, considered as host machine on serial port interface and perform the necessary plugins.
4. Start a terminal emulator such as Minicom, Hercules,Teraterm or putty and connect to the board. The serial port settings must be (Speed: 115200, Data/Parity/Stop: 8/N/1).
5. Login as root and set password as enter key.
6. Configure IP Address of the board using ifconfig command.
7. Create the file S80network in the path /mnt/flash/config/S80network
8. Set IP address and MAC address of board in S80network file present in the path /mnt/flash/config/S80network to make it static configuration.
9. Sync and reboot.

3.3.2 BSP Dependent Information

This section is not applicable on Qualcomm Platform.

3.3.3 Steps to Bring Up the Software (TeNB Binaries)

3.3.3.1 TeNB Binary loading Steps on FSM9955

To load TeNB binaries on Qualcomm, perform the following steps.

1. Login to board using telnet
2. Login as root and change password as enter key.
3. Copy the binaries into the following path on board.

   a. mdm2_00.mbn:
   /mnt/firmware/ mdm2_00.mbn

   b. rsys folder:

   /root/

4. Run sync command and reboot.

Note: The path for the rsys folder on build machine:

BUILD_ROOT/fsm99xx_ltel2/app/rsys/build/

The path for mdm2_00.mbn on build machine:

BUILD_ROOT/LINUX/project/fsm9900_cdp-fapi/platform-fsm9900_cdp-fapi

/build-target/lte-l2-1.0.0/_hexBuild/_fsm99xxCDP_1/_fsm9900_cdp/bin

3.3.3.2 TeNB Configuration Steps on FSM9955

1. For TDD, the Subframe Assignment configured in the configfile need to be configured for rfMgrProcess. This has to be done in the BSP image.
2. Open an **ssh** session to the board and perform the following steps
   a. Update the following parameters in **mib-home-fap.nv** present in **rsys/config** directory:
      - **LTE_SIGLINK_SERVER_LIST** : "MME IP ADDRESS"

   b. As part of the start_TeNB script, the CLI binary is executed and the following parameters are set as default. To modify or add any of the default configuration parameters, edit the file **/root/rsys/config/configFile**.

OAM_CONFIG_FILES_DIR ../setup

OAM_LOGGING_DIR ../setup/trace

OAM_NV_DIR_PATH ../config

OAM_TAG_LOG_FILE_NAME dbgLog

OAM_ETHERNET_INTERFACE eth1

STRONGSWAN_LEFTCERT_FILENAME board-cert.pem

STRONGSWAN_INSTALL_DIR /opt/strongswan-5.3.2

STRONGSWAN_SCRIPT_DIR .

STRONGSWAN_LEFT_ID @psk-rw

STRONGSWAN_RIGHT_ID @psk-gw

STRONGSWAN_RIGHT_SUBNET 0.0.0.0/0

STRONGSWAN_CONF_DIR /opt/strongswan-5.3.2/etc

LTE_CNM_ENABLE 0

LTE_FAP_ADMIN_STATE 1

Note:

1. The default configuration for the cell is Open Access
2. For Open Access, the cell PCI must be within the small cell PCI range and outside of the CSG PCI range.
3. For Closed Access, the cell PCI must be within the small cell PCI and CSG PCI range.

3.3.3.3 REM Configuration

REM binary is internally executed from **start_TeNB.sh** script executed as mentioned in the Section 3.3.3.5.

The following OAM parameters must be present in **rsys/config/configFile** for doing REM Scanning before running eNodeB:

```
LTE_REM_SCAN_ON_BOOT 1
LTE_SCAN_TIMEOUT 200
LTE_MAX_CELL_ENTRIES 64
LTE_IN_USE_MAX_LTE_CELL 15
REM_SCAN_ENABLE 1
LTE_REM_SCAN_ARFCN_LIST "39150"
LTE_REM_SCAN_BAND_LIST "40"
LTE_REM_SCAN_PLMN_LIST "21601"
LTE_FAP_ADMIN_STATE 0
```

3.3.3.4 CNM Configuration

CNM functionality is part of eNodeB binary and it will run when eNodeB binary is executed.

The following OAM parameters must be present in **rsys/config/configFile** for CNM feature.

```
LTE_CNM_ENABLE 1
```

3.3.3.5 Execution Steps for different scenarios

3.3.3.5.1 Steps to Run Standalone Enodeb (without CNM and REM)

1. In fsmWebBrowser, select the OAM service as "subsystem-11 tfcs" , get the list Records.
2. Click in "tfcsManagerConfig" and select the "primSrc" as "FREE_RUNNING" and "syncMode" as "TIME". Select update and do set
3. Copy the binaries to the board (mdm2_00.mbn and rsys)
4. Login to the board, do sync on the board and reboot.
5. Login to the board, Run enodeb as mentioned in the Section 3.3.3.6

3.3.3.5.2 Steps to Run Standalone Enodeb with REM (without CNM)

1. In fsmWebBrowser, select the OAM service as "subsystem-11 tfcs" , get the list Records.
2. Click in "tfcsManagerConfig" and select the "primSrc" as "NL" and "syncMode" as "PHASE". Select update and do set
3. Copy the binaries to the board (mdm2_00.mbn and rsys)
4. In the rsys/scripts/start_TeNB.sh, enable the restartSyncMgr.sh script
5. Login to the board, do sync on the board and reboot.
6. Login to the board, Run enodeb as mentioned in the Section 3.3.3.6

3.3.3.5.3 Steps to Run Enodeb with CNM & REM

1. In fsmWebBrowser, select the OAM service as "subsystem-11 tfcs" , get the list Records.

2. Click in "tfcsManagerConfig" and select the "primSrc" as "NL" and "syncMode" as "PHASE". Select update and do set
3. Copy the binaries to the board (mdm2_00.mbn and rsys)
4. Enable the CNM in configfile.
5. Ensure a Macro TDD Enodeb is running for CNM to sync (otherwise cell will not come up)
6. Login to the board, do sync on the board and reboot.
7. Login to the board, Run enodeb as mentioned in the Section 3.3.3.6

3.3.3.6 Execution of TeNB binary

3.3.3.6.1 With Oam

Execute the following command from **/root/rsys/scripts,** it configures of paths required for OAM and runs the REM and eNodeb Binaries:

./runEnb.sh

3.3.3.6.2 Without Oam

Execute the following command from **/root/rsys_withoutoam/bin,** it sets the environment variable and runs eNodeb Binary:

./runEnbWithoutOam.sh

You must see the following print on the console on Krait, once cell is UP.

```
msg: qtGn: 0001 mtGn: 0022   00->500 region: 00
dat: 60 40 04 05 00 01 00 00 02 9d 50 3c 18 c8 10 40 `@........P<...@
     c2 1c 13 50 00 00                             ...P..
     Before Vendor Params
Sending RLOG Indication  to ysStart Log Restriction
smWrProcSm: SM State [33] : WR_SM_STATE_CELL_UP
Time : 0 sec

Packets:WRITTEN[FIFO     0 SMD  71] READ[FIFO     0 SMD 607] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 563] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 563] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 564] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 563] WFCNT[FIFO   0 SMD   0] DROPS[ 0]Time : 30 sec

Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 562] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 565] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 563] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 563] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 563] WFCNT[FIFO   0 SMD   0] DROPS[ 0]Time : 60 sec

Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 565] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 563] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 562] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 567] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 564] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 563] WFCNT[FIFO   0 SMD   0] DROPS[ 0]Time : 90 sec

Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 563] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 564] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 562] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 566] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 562] WFCNT[FIFO   0 SMD   0] DROPS[ 0]Time : 120 sec

Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 564] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 562] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 564] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 565] WFCNT[FIFO   0 SMD   0] DROPS[ 0]
Packets:WRITTEN[FIFO     0 SMD   0] READ[FIFO     0 SMD 561] WFCNT[FIFO   0 SMD   0] DROPS[ 0]Time : 150 sec
```

Verify cell is configured with successful S1 setup and TTI prints are displayed in console.

Note : The rf configuration on the ConfigFile and Provision.xml should be same, if not the cell up will fail. We need to reboot the board for cellup to happen successfully.

3.4 Troubleshooting

This section describes how to troubleshoot an issue faced during the execution.

3.4.1 Registration for IPC FIFO to Hexagon FAILED

Check the mdm2_00.mbn file is copied in /mnt/firmware/ path properly. If not please do copy and do sync.

3.4.2 Low Throughput

Check the configuration common to UE Machine or Video server, TeNB DM2 or DM3 and CNE machine by executing the following commands:

```
sysctl -w net.core.rmem_max=16777216
sysctl -w net.core.rmem_default=16777216
sysctl -w net.core.wmem_max=16777216
sysctl -w net.core.wmem_default= 16777216
```

If the throughput does not improve, change the TCP on CNE computer. Run the following commands every time the board is restarted

```
eth configuration on CNE
ethtool -K eth0 rx on
ethtool -K eth0 tx on
ethtool -K eth0 sg on
ethtool -K eth0 tso on
ethtool -K eth0 ufo off
ethtool -K eth0 gso on
ethtool -K eth0 gro off
ethtool -K eth0 lro off
ethtool -K eth0 ntuple off
ethtool -K eth0 rxhash off
```

Add route on video server to direct UE traffic towards PGW by executing the following command.

route add –net<ue ip> netmask 255.255.255.0 gw<p-gw ip>

3.4.3 Message Exchange Failure between CNE or eNodeB

1. eNodeB must run with super user privilege (root). Super user privilege is required for RAW sockets used by SCTP.
2. Verify that **wr_cfg.txt** configuration file is present along with eNodeB binary inside the **rsys/config** directory.
3. Verify that the right IP addresses are provided in the **wr_cfg.txt** file or in **configFile** of OAM parameters.

3.4.4 Packet Loss Observed on Linux Machines in End-to-End Setup

If packet loss is observed in end-to-end setup before the packet reaches eNodeB in downlink direction or PGW in uplink direction, execute the following commands on machines running CNE and data server:

- **sysctl -w net.core.rmem_max= 16777216**
- **sysctl -w net.core.wmem_max= 16777216**
- **sysctl -w net.core.rmem_default= 16777216**
- **sysctl -w net.core.wmem_default= 16777216**

3.4.5 CELL bring up failure or S1 Setup Failure

1. Check if the CNEs - MME, SGW, PGW are up and running.
2. Check for PLMN mismatch between MME and eNB.
3. Check the MME IP address in **wr_cfg.txt** configuration file or in **mib-home-fap.nv** of OAM parameters.
4. Check the FAP admin state in OAM is set to **1**.
5. Check whether the eNodeB binary is running

3.4.6 UE Unable to Attach

The SIM configuration depends on type of SIM, OPC, shared key, and access control class.

1. Check the IMSI, MCC, and MNC configured in SIM matches with that of eNB and CNE.
2. Check for APN mismatch (check the APN configured in the UE).
3. Check if the appropriate band is selected in the UE for mobiles.
4. Check if the UE's IMSI is registered in the HSS.
5. Check the UE logs to see whether board is transmitting or not.

4 Building Binaries

The TOTALeNodeB Solution consists of the following binaries:

1. OAM executable and libraries
2. RRM library
3. REM binary and executable
4. eNodeB executable

4.1 Hardware and Software Requirements

4.1.1 TOTALeNodeB Deliverables

S.No.	Components	Deliverables	Description
1	OAM	Source code Executable Libraries	The TOTALeNodeB solution requires OAM for execution. The OAM component can or cannot be licensed by customers. The OAM libraries and executable are delivered to customers who have not licensed OAM. OAM libraries can be used to build eNodeB solution. Refer to *TeNB_OAM_User_Guide_1222464.pdf* for details.
2	RRM	Source code Libraries	RRM component can or cannot be licensed by customers. The RRM libraries are delivered to customers who have not licensed RRM. RRM libraries can be used to build eNodeB solution.
3	REM	Source code Executable Libraries	REM executable - REM APP interacts with Radisys OAM component and eNodeB component. REM library can be used to integrate with third party OAM components who doesn't have Radisys OAM license. Refer to *TeNB_REM_User_Guide_1222465.pdf* for details.
4	TOTALeNodeB	Source code Executable	eNodeB Application integrates the L2 and L3 protocol stacks and RRM, OAM components.

4.1.2 Compilation Tools

To build the binaries the following development tools must be installed.

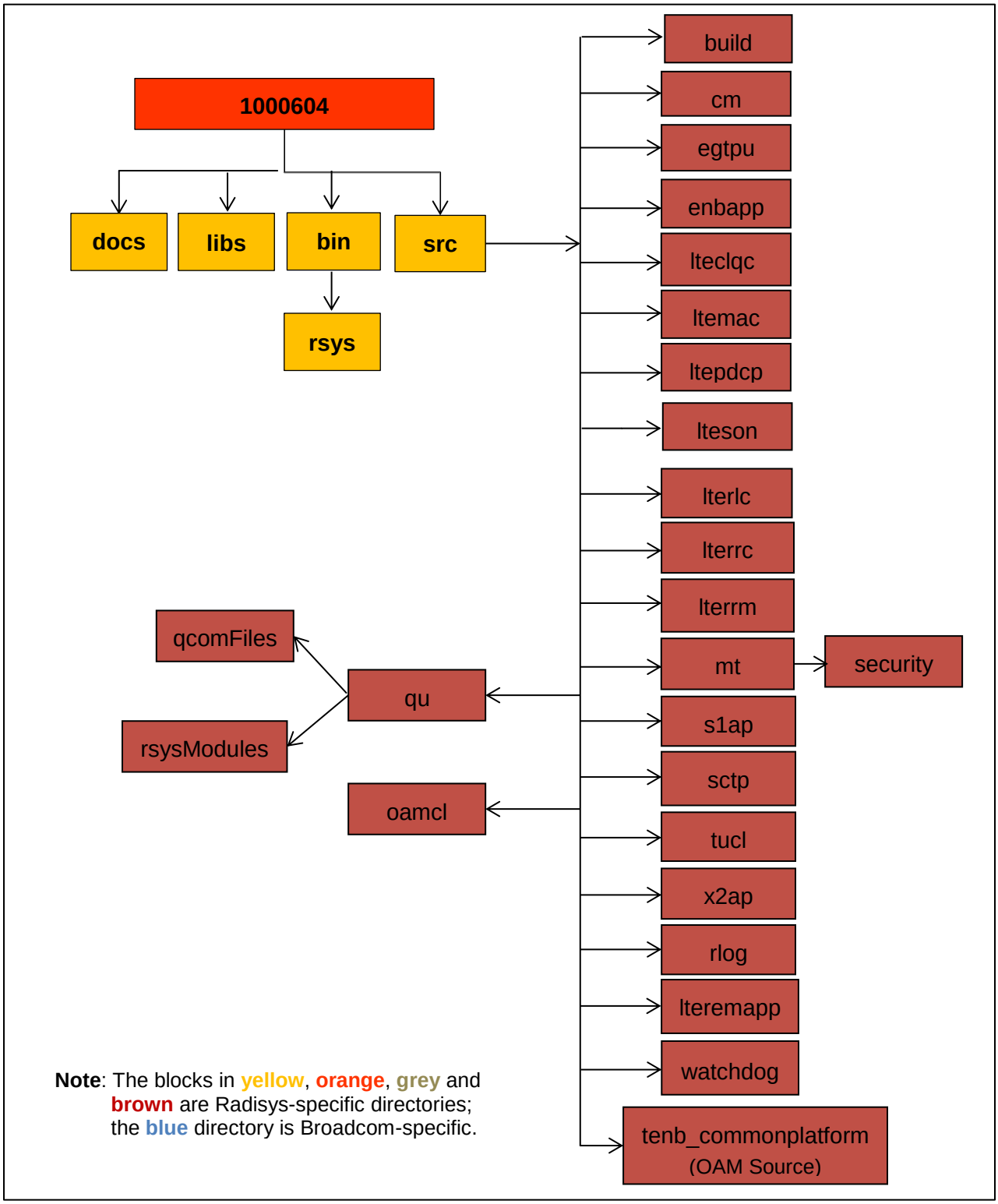
- Hexagon Toolchain
- ARM Compiler tools
- OSELAS(GCC ARM Compiler)
- PTXdist

Note: For Ubuntu packages that must be installed prior to building the Linux kernel and apps images, refer to *Qualcomm Release Notes for the release PP6.6*.

4.2 TOTALeNodeB Directory Structure

This section describes the directory structure for the TOTALeNodeB code based on Qualcomm

Figure-2: TOTALeNodeB Directory Structure



The directory structure contains TOTALeNodeB solution source files and related libraries:

1. The **docs** directory contains TOTALeNodeB documents.

2. The **src** directory contains TOTALeNodeB layers source code.
    a. The **Build** directory contains makefiles for L2 build, L3 build, object files for l2 and l3 in obj_l2 & obj and libs directory contains library files.
    b. The **cm** directory contains interface files for each layer.
    c. The **lteclqc** directory contains LTE MAC Convergence Layer.
    d. The **lterlc,ltemac and ltepdcp** directories contain source code for LTE protocol stack layer corresponding to the name of the directory.
    e. The **qu** directory contains SSI for hexagon.
    a. The **enbapp** directory contains source code of eNodeB application.
    b. The **lterrc**, **egtpu**, **s1ap**, **x2ap**, **sctp**, and **tucl** directories contain source code for LTE protocol stack layer corresponding to the name of the directory.
    c. The **lteremapp** directory contains files for REM Application and REM convergence layer. REM convergence layer file is under the **lteremapp/remcl_qcom** directory.
    d. The **lterrm** directory contains src and build sub directories. The **src** directory contains the RRM source files
    e. The **watchdog** directory contains source files for watchdog related functions.
    f. The **rlog** directory contains files for logging module.
    g. The **mt** directory contains SSI related files for Krait.
    h. The **oamcl** directory contains the file for oam_proxy client.
    i. The **lteson** directory contains the files for SON module
    j. The **tenb_commonplatform** contains OAM source files

4.3 Compilation

4.3.1 HMAC/SHA Algorithm (Third Party/Open Source)

The HMAC/SHA algorithm is used to generate RRCenc, RRCupenc and RRCint keys from KeNB.

The steps to download the source code and integrate are:

1. Open the download link: http://sourceforge.net/projects/beecrypt/
2. Download file (version): **beecrypt-4.2.1.tar.gz**
3. Copy the **.tar** file to **<target directory>/mt/security/** by executing the following command:
    - **cp –rf beecrypt-4.2.1.tar.gz <target directory>/mt/security/**
    - **cd <target directory>/mt/security/**
4. Extract the contents by executing the following command:

    tar –xzvf beecrypt-4.2.1.tar.gz

    The **beecrypt-4.2.1** folder is extracted under the **<target directory>/mt/security/** directory.
5. Create the directory **<target directory>/mt/security**
6. Copy all **.h** files directory from **<target directory>/mt/security/beecrypt-4.2.1/include/beecrypt/** directory to **<target directory>/mt/security/** directory:

    cp <target directory>/mt/security/beecrypt-4.2.1/include/beecrypt/*.h <target directory>/mt/security/

7. Copy the following files from **<target directory>/mt/security/beecrypt-4.2.1/** directory to **<target directory>/mt/security/** directory:

   cp endianness.c, hmac.c, hmacsha256.c, mp.c, sha256.c, sha2k32.c <target directory>/mt/security/

8. Open the following files and change the path from **beecrypt/xxx.h** to **xxx.h** (**xxx** refers to include file name):
   a. **api.h, beecrypt.h, endianness.h, hmac.h, hmacsha256.h, memchunk.h, mp.h, mpnumber.h, sha2k32.h, sha256.h, mpopt.h, gnu.h**
   b. **endianness.c, hmac.c, hmacsha256.c, mp.c, sha256.c, sha2k32.c**

4.3.2 Preparation of Compilation Folder

The following need to be done before compilation.

1. Update the following path variables:
   a. In Bash export the arm-v7a and hexagon cross compiler path.

      Eg:

      i. export PATH=$PATH:/opt/OSELAS.Toolchain-2014.12.1/arm-v7a-linux-gnueabi/gcc-4.9.2-glibc-2.20-binutils-2.24-kernel-3.16-sanitized/bin/
      ii. export PATH=$PATH:/opt/Qualcomm/HEXAGON_Tools/5.0.13/gnu/bin

   b. In code change the cross compiler path for Hexagon and arm in the below mentioned files
      i. In the file BUILD_ROOT/ LINUX/project/target/common/Makefile, set the macro CROSS_PATH with the arm-v79 bin folder

         Eg: CROSS_PATH=/opt/OSELAS.Toolchain-2014.12.1/arm-v7a-linux-gnueabi/gcc-4.9.2-glibc-2.20-binutils-2.24-kernel-3.16-sanitized/bin

      ii. In the file BUILD_ROOT/fsm99xx_ltel2/ targets/make.target.paths, set the macro HEXAGON_ROOT with the hexagon compiler bin folder

         Eg: HEXAGON_ROOT = /opt/Qualcomm/HEXAGON_Tools/5.1.06

2. Disable the Qcom Test Build. Follow the below steps to do the same.
   a. Go to the path **BUILD_ROOT/LINUX/target/fsm9900_cdp**
   b. Run the below command

      $> **make platformconfig**

   c. You will get a pop-up window. Now go down using down arrow and select **Target specific QTI components** and press Enter.
   d. In the new window, again using down arrow scroll down and select **QTI LTE specific components** and press Enter.
   e. Next select **Various LTE Modules** and press Enter.
   f. Next scroll down to **Enable lte-l2 test** and disable it by pressing space bar. You will see the ' * ' mark infront of the **Enable lte-l2 test** is disappeared.
   g. Next select **Save** by using the right arrow and press Enter.
   h. Now press Enter for **OK**
   i. Press Enter again to exit.
   j. Now select Exit and press Enter.
   k. Do Exit four times.

l. Now we have disabled the Qcom Test modules from being compiled.

4.3.3 Build TeNB with OAM

L 2 Compilation :

- Go to eNodeB compilation directory

  cd BUILD_ROOT/fsm99xx_ltel2/app/rsys/build

- Execute the following command to generate L2 Image

  1. Copy all the files mentioned in the setL2BuildEnv.sh file into **rsys/qu/qcomFiles**.
  2. Apply the patch **pp_6.7.1_rsys_int_patch** file to the files in the directory **rsys/qu/qcomFiles**. This is to modify Qualcomm files to integrate with Radisys L2 stack.
     Ex: patch < pp_6.7.1_rsys_int_patch
  3. Run the below script to update the Qcom Files with Radisys changes

     ./setL2BuildEnv.sh

  4. Clean the Rsys Binaries by using following command

     ./makeL2.sh clean

  5. Clean the Qcom code by following command

     ./makeL2.sh cleantarget

  6. Compile the Qcom bsp code by following command. This is required to be done only once, when compiling the Qcom code base for first time, that is if you have taken new verison of Qcom code or if we have moved the Qcom code to different folder.

     Else you can skip this step and run only step 7.

     ./makeL2.sh bspclean

     ./makeL2.sh bsp

     skip step 7.

  7. Compile the Qcom code

     ./makeL2.sh target

     Note: Ignore the linking error for rsys object files

  8. Compile the Rsys L2 code

     ./makeL2.sh

Note: The L2 image (mdm2_00.mbn) will be present in the path mentioned below:

BUILD_ROOT/LINUX/project/fsm9900_cdp-fapi/platform-fsm9900_cdp-fapi/build-target

/lte-l2-1.0.0/_hexBuild/_fsm99xxCDP_1/_fsm9900_cdp/bin

L 3 Compilation :

To compile L3 Stack , REM and OAM library, execute the following commands.

For OAM to compile we need some open sources to be downloaded . Please refer the OAM user guide [2] for the steps. Also you can run the script **tpinstall.sh** in the path **BUILD_ROOT/fsm99xx_ltel2/app/rsys/build/**

- Go to eNodeB compilation directory

  cd BUILD_ROOT/fsm99xx_ltel2/app/rsys/build

- Set the environment variables using the below command.

  sh setL3Var.sh

- Command to clean up the OAM, REM and L3 stack binaries

  make clean_all

- Execute the following command to generate eNodeB binaries with OAM

  make tenb_oam

  This build command internally invokes **enodeb_qcom.mak** makefile generates **rsys** folder in **app/rsys/build** directory which contains eNodeB binary.

- Command to clean up only L3 stack binaries

  make clean

- Command to see the available compilation options

  make help

On successful compilation complete package with binaries will be found at
BUILD_ROOT/fsm99xx_ltel2/app/rsys/build/rsys

Note: The rlog.logdb need to be manually generated after compiling both L3 and L2. Please refer the section "Generation of rlog.logdb" in Appendix III for the steps

4.3.4 Build TeNB without OAM

L 2 Compilation :

Same as mentioned in with oam section 4.3.3

L 3 Compilation :

To compile L3 Stack , REM and OAM library, execute the following commands.

- Go to eNodeB compilation directory

  cd BUILD_ROOT/fsm99xx_ltel2/app/rsys/build

- Set the environment variables using the below command.

  sh setL3Var.sh

- Command to clean up the L3 stack binaries

  make clean

- Execute the following command to generate eNodeB binaries with OAM

  make tenb

  This build command internally invokes **enodeb_qcom.mak** makefile generates **rsys** folder in **app/rsys/build** directory which contains eNodeB binary.

- Command to see the available compilation options

  make help

On successful compilation complete package with binaries will be found at
BUILD_ROOT/fsm99xx_ltel2/app/rsys/build/rsys_withoutoam

Note: The rlog.logdb need to be manually generated after compiling both L3 and L2. Please refer the section “Generation of rlog.logdb” in Appendix III for the steps

5 TOTALeNodeB Logging - Reporting Problems

The following information is requested to be submitted when reporting a problem.

1. Description of the problem
2. Software Versions
    a. Physical layer version can be obtained from L1 console logs or from the *Release Notes* in the delivered software package.
    b. Upper layer version can be obtained from the *Release Notes* in the delivered software package.
3. Logs – classified into the following categories:
    a. Rsys Logs - These logs are generated by the executed Radisys Stack. The L3 and L2 logs are present in the /root/rsys/setup/trace folder.
    b. Qcom Logs –These logs are generated by the executed Qcom applications. The logs are stored in /var/log/messages file.
4. Crash Details and core dumps. Section 5.1 and 5.2 tells about the path where the crash details are present.

Note: Report problems through our defect tracking system at https://tracker.radisys.com/

5.1 Qcom Logs

Below are the commands and path of the Qcom logs.

1. The L2 and L1 Logs can be found in the file **/var/log/messages**
2. Execute the following command to retrieve L1 crash log information and status.
    - **`/opt/qcom/bin/memdump 0x19700000 0x80000 > l1dump.txt`**
3. Execute the following commands to check the L2(Hexagon) status.
    - **`/opt/qcom/bin/memdump 0x1990000C 512`**
4. When there is crash in L2 or L1 the Qcom crash logs and crash details will be stored in a folder in the path /mnt/flash/halt event/ENGINEERING/<crash_logs_folder>
   If in case for any reason the “crash_logs_folder” is not created use the below command to retrieve the L2 crash dump
    - **`/opt/qcom/bin/memdump 0x19900000 0x80000 > hex2.dmp`**
5. L1 serial console logs. To configure serial port, refer to *Qualcomm User Guide*..

5.2 TeNB Logs

The TeNB logs will be stored in the path / root/rsys/setup/trace/

1. The logs can be in text format or binary format, depending on the compilation. Refer to the Appendix III to convert the binary logs to text format.
2. When there is a crash the coredump will be generated in the path /mnt/flash/coredumps
3. TeNB logs can be seen live on remote server. Refer to Appendix III for the steps.

5.3 Wireshark Logs

The following logs can captured and analysed through wireshark .

1. FAPI messages: Messages exchanged between L1 and L2 layers. Refer to the Qcom document *80-F5430-1_HEXAGON V5 FOR FSM99XX DEVELOPER'S GUIDE FOR RELEASE 6.X* to capture this logs
2. X2 Handover logs: Messages exchanged between Source eNB and Target eNB. Execute the following command in either Source eNB or Target eNB to collect this logs.
    - **`tcpdump`**
3. S1 Handover logs: Messages exchanged between Source eNB, MME and Target eNB. Execute the following command in the MME machine to collect this logs.
    - **`tcpdump/wireshark`**

6 Appendix – I

Configuration parameters of TeNB without OAM (**wr_cfg.txt**)

Table-1: wr_cfg.txt Configuration File

Parameters	Value	Description
WR_TAG_CELL_ID	19	Cell ID.
WR_TAG_OP_MODE	4	PHY Operation mode 0 – CPRI (default) 1 – Timer based (used for debugging only) 3 – External Event (used for debugging only) 4 – RF
WR_TAG_PERIOD	0	Period of the timer. Valid values are: 5 = CPRI MIMO, 2 = MIMO RF, 0 = SISO
WR_TAG_MOD_TYPE	4	Modulation Type: BPSK, QPSK, 16QAM, or 64QAM.
WR_TAG_DUP_MODE	2	Duplexing mode: TDD or FDD.
WR_TAG_TDD_ULDL_CFG_MODE	2	TDD subframe configuration mode 1 and 2 are supported.
WR_TAG_TDD_SPCL_SF_CONFIG	7	TDD special subframe configuration 7 is supported.
WR_TAG_MAX_UE_SUPPORT	32	Maximum number of UEs supported in a cell. The maximum number of UEs is the combination of UEs that enter with establishment cause as MO_DATA, MT_ACCESS, HIGH PRIORITY ACCESS, EMERGENCY, and MO_SIGNALLING. If maximum number of UE limit reaches, only signaling UEs are accepted. Default 32 active UEs are configured.
WR_TAG_MCC_0	3	MCC0 (for example: if PLMN is 31142).
WR_TAG_MCC_1	1	MCC1
WR_TAG_MCC_2	1	MCC2
WR_TAG_MNC_0	4	MNC0

Parameters	Value	Description
WR_TAG_MNC_1	2	MNC1
WR_TAG_MNC_2	0	MNC2
WR_TAG_TA_CODE	1	Tracking Area Code.
WR_TAG_FREQ_BAND_IND	40	Frequency Band Indicator.
WR_TAG_DL_EARFCN	39150	DL EARFCN value for Band 40.
WR_TAG_UL_EARFCN	39150	UL EARFCN value for Band 40. This value is only used for broadcast. If value is set to 0, UL EARFCN value is not broadcasted in SIB2.
WR_TAG_ENB_IP_ADDR	172.26.2.82	IP address of the server intended to execute the eNodeB.
WR_TAG_PCI_SELECT_TYPE	1	Enables or disables the SON PCI Selection feature. Valid values are: 0 = Disable SON PCI feature, 1 = Enable SON PCI feature.
WR_TAG_PRACH_SELECT_TYPE	1	Enables or disables the SON PRACH Selection feature. Valid values are: 0 = Disable SON PRACH feature, 1 = Enable SON PRACH feature.
WR_TAG_EARFCN_SELECT_TYPE	1	Enables or disables the SON EARFCN Selection feature. Valid values are: 0 = Disable SON EARFCN feature, 1 = Enable SON EARFCN feature.
WR_TAG_PCI_LIST	{{1, 2, 3,4}}	PCI list to be configured for cell bring up.
WR_TAG_DL_EARFCN_LIST	{{39150}}	EARFCN DL list to be configured for cell bring up. This can be configured with a single value or a list of values.
WR_TAG_UL_EARFCN_LIST	{{39150}}	EARFCN UL list to be configured for cell to come up. This can be configured with a single value or a list of values.

Parameters	Value	Description
WR_TAG_ROOTSEQ_IDX_LIST	{{823, 10, 18}}	List of PRACH root-sequence indices to be used for SON PRACH selection feature. Can have a single value or multiple values.
WR_TAG_PRACHCFG_IDX_LIST	{{1, 2, 48}}	List of PRACH configuration indices to be used for SON PRACH selection feature. Can have a single value or multiple values.
WR_TAG_ZERO_CORR_ZONE_CFG_LIST	{{8,10, 14}}	List of PRACH Zero correlation zone configuration values to be used for SON PRACH selection feature. Can have a single value or multiple values.
WR_TAG_PRACH_FREQ_OFFSET_LIST	{{1, 5}}	List of PRACH frequency offset values to be used for SON PRACH selection feature. Can have a single value or multiple values.
WR_TAG_ROOTSEQ_IDX	823	If SON is disabled, this values indicates the serving PRACH Root Sequence Index to be configured.
WR_TAG_PRACHCFG_IDX	1	If SON is disabled, this values indicates the serving PRACH Configuration Index to be configured.
WR_TAG_ZERO_CORR_ZONE_CFG	10	If SON is disabled, this values indicates the serving PRACH zero correlation zone configuration value to be configured.
WR_TAG_PRACH_FREQ_OFFSET	1	If SON is disabled, this value indicates the serving PRACH frequency offset value to be configured.
WR_TAG_NO_OF_MME_INFO	1	Number of MMEs to be configured.
WR_TAG_MME_INFO	{{1, 172.26.2.86}}	Provide IP address of server intended to execute MME. Valid values are: Parameter 1 = MME ID, Parameter 2 = MME IP address.
WR_TAG_SCTP_IP_ADDR	172.26.2.82	Provide IP address of server intended to execute eNodeB.
WR_TAG_ENB_IP_ADDR_IPV6	2000::10	Provide IPV6 address of server intended to run eNodeB.
WR_TAG_NO_OF_MME_INFO_IPV6	1	Number of IPV6 MMEs

Parameters	Value	Description
WR_TAG_MME_INFO_IPV6	{{1, 2000::40}}	Provide IPV6 address of server intended to run MME.
WR_TAG_SCTP_IP_ADDR_IPV6	2000::10	Provide IPV6 address of server intended to run eNodeB.
WR_TAG_HI_DBG	0	To enable TUCL debug prints. To enable layer wise logs, value of WR_TAG_XX_DBG need to set to 1. These logs are stored in ccpu.log and not visible at run time. User can see the prints in ccpu.log once system crashed or manually stopped.
WR_TAG_SB_DBG	0	To enable SCTP debug prints.
WR_TAG_SZ_DBG	0	To enable S1AP debug prints.
WR_TAG_EG_DBG	0	To enable eGTP debug prints.
WR_TAG_WR_DBG	0	To enable eNodeB application debug prints.
WR_TAG_NH_DBG	0	To enable RRC debug prints.
WR_TAG_KW_DBG	0	To enable RLC debug prints.
WR_TAG_RG_DBG	0	To enable MAC debug prints.
WR_TAG_YS_DBG	0	To enable Convergence Layer debug prints.
WR_TAG_SM_DBG	0	To enable Layer Manger debug prints.
WR_TAG_INACTIVITY_TIMER_VAL	4000	Specifies the time in seconds after which the inactivity timer in the eNodeB expires.
WR_TAG_END_MARKER_TIMER_VAL	10	Timer for END Marker packet.
WR_TAG_MAX_EXPIRY	30	Specifies the number of expiries after which the inactivity of the UE is detected.
WR_TAG_CZ_DBG	0	To enable X2AP debug prints.
WR_TAG_X2_PREP_TMR	1000000	The time to wait for reception of the HandoverCommand message after sending the HandoverRequired from the eNB to the MME.
WR_TAG_X2_OVRALL_TMR	1000000	The time to wait for the UEContextRelease message from the target eNB after receiving the HandoverRequestAcknowledge message from the target eNB and handover is complete.

Parameters	Value	Description
WR_TAG_ENB_NAME	0	The name of the home eNB. Broadcast to the UE through SIB (System Information Block) 9 when the cell is operated as a CSG cell or as a hybrid cell in bytes.
WR_TAG_NO_OF_BRDCST_PLMN	1	Number of broadcast PLMN IDs.
WR_TAG_PLMN_ID_LST	{31142}	List of PLMN IDs (if PLMN is 31142).
WR_TAG_CELL_FDD_CFG	{0,1,2,3}	FDD specific Cell Configuration.
WR_TAG_CELL_TDD_CFG	{0,1,2,3,4,5}	TDD specific Cell Configuration.
WR_TAG_NO_OF_NGH_INFO	1	Number of neighbors' information.
WR_TAG_NGH_INFO_CFG	{{0,1},2,3}}	Configuration of neighbor information.
WR_TAG_NO_OF_GU_GRP	1	Number of MME groups.
WR_TAG_GU_GRP_ID_CFG	{{0,1}}	List of MME Group IDs to be connected to the eNB.
WR_TAG_S1_PREP_TMR	100000	The time to wait for reception of the HandoverCommand message after sending the HandoverRequired from the eNB to the MME. Value should be 20000 for HO.
WR_TAG_S1_OVRALL_TMR	100000	The time to wait for the UEContextReleaseCommand message from the MME after the HandoverCommand message from the eNB is received by the MME and handover is complete. Value should be 20000 for HO.
WR_TAG_MEAS_CFG_ENB	1	To enable measurement configuration.
WR_TAG_RRM_RNTI_STRT	205	Start RNTI for RRM, but currently CRNTI management is handled by MAC Scheduler.
WR_TAG_MAX_RRM_RNTIS	20	Maximum RNTIs managed by RRM.
WR_TAG_MAC_RNTI_STRT	61	Start RNTI for MAC.
WR_TAG_MAX_MAC_RNTIS	60	Maximum RNTIs managed by MAC.
WR_TAG_RRM_NO_OF_DED_PREMBL	10	Dedicated preambles for RRM.
WR_TAG_RRM_DED_PREMBL_STRT	41	Initial rapId for RRM.
WR_TAG_MAC_NO_OF_PREMBL	6	The number of non-dedicated preambles.

Parameters	Value	Description
WR_TAG_A1_RSRP_THRSHLD_VAL	90	Threshold value for the event A1. used for inter HO.
WR_TAG_A2_RSRP_THRSHLD_VAL	6	Threshold value for the event A2.
WR_TAG_INTRA_A5_RSRP_THRSD1_VAL	65	This is parameter value is used in Threshold1 in A5 report configuration of RRC reconfiguration message. Present in RRC Reconfiguration message only by selecting the WR_TAG_HO_REPORT_CFG_VAL is 2 for A5 based HO.
WR_TAG_INTRA_A5_RSRP_THRSD2_VAL	70	This is parameter value is used in Threshold2 in A5 report configuration of RRC reconfiguration message. Present in RRC Reconfiguration message only by selecting the WR_TAG_HO_REPORT_CFG_VAL is 2 for A5 based HO.
WR_TAG_INTER_A5_RSRP_THRSD1_VAL	65	The RSRP Threshold1 value for the inter A5 event. If neighbor cell RSRP value is greater than configured Thresold1 and the service cell RSRP value is worse than Threshold2, the service cell can initiate handover.
WR_TAG_INTER_A5_RSRP_THRSD2_VAL	70	The RSRP Threshold2 value for the inter A5 event.
WR_TAG_INTRA_HO_A3_OFFSET	10	The A3 Offset for Handover. Offset value is 10.
WR_TAG_INTRA_ANR_A3_OFFSET	5	The A3 Offset for ANR. Offset values is 5.
WR_TAG_INTER_ANR_A5_RSRP_THRSD1_VAL	75	The RSRP Threshold1 value for inter A5 event configured for ANR.
WR_TAG_INTER_ANR_A5_RSRP_THRSD2_VAL	50	The RSRP Threshold2 value for inter A5 event configured for ANR.
WR_TAG_ANR_REPORT_CFG_VAL	3	ANR Report Configuration. Valid values are: 0 = No ANR, 1 = A3 event ANR for intra, 2 = A5 event ANR for intra, 3 = Periodic ANR. 4 = inter and intra ANR
WR_TAG_HO_REPORT_CFG_VAL	1	Handover Report Configuration. Valid values are: 1 = A3, 2 = A5.

Parameters	Value	Description
WR_TAG_RSRQ_THRSHLD_VAL	0	RSRQ threshold for handover decision. Range: 0 to 34.
WR_TAG_ANR_EPOC_TMR_VAL_IN_SECS	1000	EPOCH timer value.
WR_TAG_UTRA_B2_RSRP_THRSD1_VAL	70	RSRP threshold value 1 for B2 event.
WR_TAG_UTRA_FDD_B2_RSCP_THRSD2_VAL	65	RSCP threshold value 2 for B2 event for UTRA FDD (to be used for IRAT HO).
WR_TAG_UTRA_TDD_B2_RSCP_THRSD2_VAL	65	RSCP threshold value 2 for B2 event for UTRA TDD (to be used for redirection).
WR_TAG_ANR_TRICE_INTV_COUNT	10	TRICE timer value = EPOCH timer value / TRICE interval count.
WR_TAG_S_MEASURE_VAL	0	Serving cell quality threshold controlling the UE to perform measurements or not. Value “0” disables the s-Measure function.
WR_TAG_INTRA_TTT_VAL	7	Trigger time used in Inter-frequency.
WR_TAG_INTRA_HYTERISIS	1	Hysteresis parameter used within the entry and exit state of an event triggered reporting condition – (not used).
WR_TAG_NO_OF_NGH_ENB_CFG	INVLD	Number of neighbor eNodeBs configured.
WR_TAG_NGH_ENB_CFG	INVLD	Neighbor eNodeB configuration.
WR_TAG_ENB_TYPE	1	eNodeB type - (Macro eNB(0), Home eNB(1)).
WR_TAG_PCI_VAL	1	Physical Cell ID. Note: No 2 eNBs should have the same PCI value.
WR_TAG_DL_NUM_UE_PER_TTI	2	Configuring number of UEs per TTI for DL. Valid values are: 1 = Minimum value (default), 2 = Maximum value.
WR_TAG_UL_NUM_UE_PER_TTI	2	Configuring number of UEs per TTI for UL. Valid values are: 1 = Minimum value (default), 2 = Maximum value.

Parameters	Value	Description
WR_TAG_MAX_DL_UE_PER_TTI	2	Configuring maximum number of UEs per TTI for DL. Valid values are: 1 = Minimum value (default), 2 = Maximum value.
WR_TAG_MAX_UL_UE_PER_TTI	2	Configuring maximum number of UEs per TTI for UL. Valid values are: 1 = Minimum value (default), 2 = Maximum value.
WR_TAG_NO_OF_EAID_INFO	1	Number of emergency IDs available in WR_TAG_EAID_LIST_INFO.
WR_TAG_EAID_LIST_INFO	{1}	List of emergency IDs supported by our system. MME uses the same ID for warning types as 'Emergency'.
WR_TAG_DL_SCHD_TYPE	2	Configuring DL Scheduler type. Valid values are: 1 = PFS, 2 = RR (default).
WR_TAG_UL_SCHD_TYPE	2	Configuring UL Scheduler type. Valid values are: 1 = PFS, 2 = RR (default).
WR_TAG_DLFS_SCHD_TYPE	2	Enable or disable the DLFSS feature. Valid values are: 0 = Disable DLFSS feature 1 = Enable DLFSS feature
WR_TAG_PFS_DL_TPT_COEFFICIENT	0..10	DL Throughput Coefficient(α), defines the degree of prioritization for optimal throughput. Default value = 0
WR_TAG_PFS_DL_FAIRNESS_COEFFICIENT	0..10	DL Fairness Coefficient(β), defines the degree of prioritization for optimal fairness. Default value = 0

Parameters	Value	Description
WR_TAG_PFS_UL_TPT_COEFFICIENT	0..10	UL Throughput Coefficient(α), defines the degree of prioritization for optimal throughput. Default value = 0
WR_TAG_PFS_UL_FAIRNESS_COEFFICIENT	0..10	UL Fairness Coefficient(β), defines the degree of prioritization for optimal fairness. Default value = 0
WR_TAG_DL_QCI_SCHD_WGT	8,6,7,5,9,4,3,2,1	Default DL QCI Weights for QCIs corresponding from 1 to 9 Range : 1 .. 99
WR_TAG_UL_QCI_SCHD_WGT	8,6,7,5,9,4,3,2,1	Default UL QCI Weights for QCIs corresponding from 1 to 9 Range : 1 .. 99
WR_TAG_TM_AUTO_CONFIG	0	Transmission Mode selection by eNodeB. 0 = OFF | 1 = ON Default value = 0
WR_TAG_PREFERRED_TM	4	Transmission Mode selection by User. TM2 = 2 | TM3 = 3 | TM4 = 4 Default value = 4
WR_TAG_MAX_X2_PEERS	5	Maximum number of X2AP peers.
WR_TAG_X2_TIME_TO_WAIT	200000	The TimetoWait value included in the X2SetupFailure message sent by the eNB when an X2SetupRequest message is received.
WR_TAG_SCTP_SRVC_TYPE	0	SCTP Service type. Valid values are: 0 = SCTP over RAW IP, 1 = SCTP over UDP.
WR_TAG_DIAG_TUCL	{{0,10}}	Enable or disable the log level configuration for TUCL. Valid values are: 0 = Disable the TUCL log, 1 = Enable the TUCL log, 10 = Number of levels that must be enabled.

Parameters	Value	Description
WR_TAG_DIAG_S1AP	{{0,10}}	Enable or disable the log level configuration for S1AP. Valid values are: 0 = Disable the S1AP log, 1 = Enable the S1AP log, 10 = Number of levels that must be enabled.
WR_TAG_DIAG_EGTP	{{0,10}}	Enable or disable the log level configuration for eGTP-c. Valid values are: 0 = Disable the eGTP-c log, 1 = Enable the eGTP-c log, 10 = Number of levels that must be enabled.
WR_TAG_DIAG_APP	{{0,10}}	Enable or disable the log level configuration for eNodeBApp. Valid values are: 0 = Disable the eNodeBApp log, 1 = Enable the eNodeBApp log, 10 = Number of levels that must be enabled.
WR_TAG_DIAG_LTERRC	{{0,10}}	Enable or disable the log level configuration for LTE RRC. Valid values are: 0 = Disable the LTE RRC log 1 = Enable the LTE RRC log 10 = Number of levels that must be enabled.
WR_TAG_DIAG_LTERLC	{{0,10}}	Enable or disable the log level configuration for LTE RLC. Valid values are: 0 = Disable the LTE RLC log, 1 = Enable the LTE RLC log, 10 = Number of levels that must be enabled.

Parameters	Value	Description
WR_TAG_DIAG_LTEPDCP	{{0,10}}	Enable or disable the log level configuration for LTE PDCP. Valid values are: 0 = Disable the LTE PDCP log, 1 = Enable the LTE PDCP log, 10 = Number of levels that must be enabled.
WR_TAG_DIAG_LTECL	{{0,10}}	Enable or disable the log level configuration for LTE CL. Valid values are: 0 = Disable the LTE CL log, 1 = Enable the LTE CL log, 10 = Number of levels that must be enabled.
WR_TAG_DIAG_LTEMAC	{{0,10}}	Enable or disable the log level configuration for LTE MAC. Valid values are: 0 = Disable the LTE MAC log, 1 = Enable the LTE MAC log, 10 = Number of levels that must be enabled.
WR_TAG_DIAG_X2AP	{{0,10}}	Enable or disable the log level configuration for X2AP. Valid values are: 0 = Disable the X2AP log, 1 = Enable the X2AP log, 10 = Number of levels that must be enabled.
WR_TAG_DIAG_SCTP	{{0,10}}	Enable or disable the log level configuration for SCTP. Valid values are: 0 = Disable the SCTP log, 1 = Enable the SCTP log, 10 = Number of levels that must be enabled.
WR_TAG_S1_RESET_TMR	1000	S1 Reset timer.
WR_TAG_X2_RESET_TMR	60000	X2 Reset timer.
WR_TAG_SCTP_RTO_MIN	100	SCTP RTO minimum value (100).
WR_TAG_SCTP_RTO_MAX	1000	SCTP RTO maximum value (1000).

Parameters	Value	Description
WR_TAG_SCTP_RTO_INITIAL	200	SCTP RTO initial value (200).
WR_TAG_SCTP_HRTBEAT_INTERVAL	5000	SCTP heartbeat interval value (5000).
WR_TAG_UL_ENABLE_TIME	1	PHY logging interval in seconds.
WR_TAG_NUM_EUTRA_FREQ	3	Number of E-UTRA frequencies.
WR_TAG_EUTRA_FREQ_CFG	{{5230, 23230}, {2600,20600},{39150,39150}}	List of E-UTRA frequency (both Inter- and Intra-frequency) configurations. Ensure at least one Intra- and Inter-frequency is configured. Otherwise, SIB4 and or SIB5 message building fails.
WR_TAG_NUM_UTRA_FREQ	2	Number of UTRA frequencies.
WR_TAG_UTRA_FREQ_CFG	{{10713,23230}, {10714, 23231}}	List of UTRA frequency configurations.
WR_TAG_NO_OF_NGH_CFG	2	The number of target base stations for multi-target preparation during handover. Maximum of four eNBs are prepared. If the value entered is 1, the multi-target preparation is not executed.
WR_TAG_NGH_CELL_CFG	{1,172.27.3.95,141,1,1,21901,3100,21100,0,0,24}	List of neighbor cell configurations. {{ eNodeB type: 0 – Macro, 1- Home eNB, IP address, Physical Cell ID, TAC, Cell ID, PLMN ID, DL ARFCN, UL ARFCN, Is X2 required: 0 – disabled, 1 – enabled, Start RB, End RB, }}
WR_TAG_NO_OF_NGH_CFG_IPV6	1	Number of IPV6 target base stations for multi-target preparation during handover. Maximum of four eNBs can be prepared. If the value entered is 1, the multi-target preparation is not executed.

Parameters	Value	Description
WR_TAG_NGH_CELL_CFG_IPV6	{{0,2000::10,1,1,1,22020,38850,38850,0,2,2,7,0,0,60,40}}	List of IPV6 neighbor cell configurations. The parameter values are: 0 = eNodeB type, 2000::10 = eNodeB IPV6 address, 1 = Physical Cell ID, 1 = TAC, 1 = eNodeB ID, 22020 = PLMN ID, 38850 = DL EARFCN, 38850 = UL EARFCN, 0 = Trigger X2, 2 = Number of antennas, 2 = UL-DL subframe configuration, 7 = Special subframe information, 0 = DL Cyclic Prefix, 0 = UL Cyclic Prefix, 60 = Reference Symbol Received Power, 40 = Received Signal Strength Indicator.
WR_TAG_NO_OF_UTRA_FDD_NGH_CFG	2	Number of UTRA FDD neighbor cells configurations.

Parameters	Value	Description
WR_TAG_NGH_UTRA_FDD_CELL_CFG	{{10, 70, 10713, 23230, 6, 1, 21901, 145, 45, 0,1,1}, {20, 71, 10714, 23231, 10, 1, 21901, 150, 50.0,1,1 }}	List of UTRA FDD cell configurations. The parameter values are: 10 = RNC ID 70 = Cell ID 10713 = DL ARFCN 23230 = UL ARFCN 6 = PSC 1 = Number of PLMN 21901 = PLMN (mcc0, mcc1, mcc2, mnc0, mnc1) 145 = LAC 45 = RAC 0 = RIM support flag (1 = enable, 0 = disable and default) 1 = VoipCapable flag (1 = enable, 0 = disable and 1 default) 1 = psHoCapable flag (1 = enable, 0 = disable and 1 default)
WR_TAG_NGH_UTRA_CELL_CFG	{{10,70, 172.27. 2.100,1 0713,23 230},{2 0,71,17 2.27.2.1 05,1071 4,23231 }}	List of UTRA cell configurations.
WR_TAG_NUM_CDMA_1XRTT_BAND_CLS	1	Number of CDMA 1xRTT Band Classes.
WR_TAG_CDMA_1XRTT_BAND_CLS	{{1,1,1, 1}}	CDMA 1xRTT Band Class. The parameter values are: Parameter 1 = bandClass, Parameter 2 = Cell Reselector, Parameter 3 = thresholdXhigh, Parameter 4 = thresholdXLow.
WR_TAG_NUM_CDMA_1XRTT_NEIGH_FREQ	1	Number of NGH CDMA 1xRTT frequency configurations.

Parameters	Value	Description
WR_TAG_CDMA_1XRTT_NEIGH_FREQ	{{1,1000,1}}	NGH CDMA 1xRTT frequency configuration. The parameter values are: Parameter 1 = bandClass, Parameter 2 = arfcn, Parameter 3 = FreqPriority.
WR_TAG_NUM_CDMA_1XRTT_NEIGH_CELL	1	Number of CDMA 1xRTT NGH Cells.
WR_TAG_CDMA_1XRTT_NEIGH_CELL	{{1,1000,1,1,1}}	NGH CDMA 1xRTT Cell configuration. The parameter values are: Parameter 1 = bandClass, Parameter 2 = arfcn, Parameter 3 = pnOffset, Parameter 4 = Current Rank, Parameter 5 = NGH cell flag.
WR_TAG_CSFB_CFG_VAL	0,1	CSFB Configuration value. 0 = CSFB without Measurement, 1 = CSFB with Measurement.
WR_TAG_ECSFB_CFG_VAL	0,1,2	eCSFB Configuration value. Valid values are: 0 = eCSFB not supported, 1 = eCSFB without Measurement, 2 = eCSFB with Measurements.
WR_TAG_DUAL_RX_SUPPORTED	1	dualRx supported by network (value “0” not supported).

Parameters	Value	Description
WR_TAG_AS_PRI_INTG_ALGO_LST	{1}	Enable or disable Integrity Protection on AS Security: 0 = EIA0 1 = 128-EIA1 (SNOW3G) 2 = 128-EIA2 (AES) 3 = 128-EIA3 (ZUC)
WR_TAG_AS_PRI_CIPH_ALGO_LST	{1}	Enable or disable Ciphering on AS Security: 0 = EEA0 1 = 128-EEA1 (SNOW3G) 2 = 128-EEA2 (AES) 3 = 128-EEA3 (ZUC)
WR_TAG_A3_OFFSET	-6	ANR Event A3 Offset value.
WR_TAG_PICO_OFFSET	20	LTE-Advanced CRE Event Cell Individual Offset.
WR_TAG_ABS_PATTERN_TYPE	2	ABS subframes pattern type indicates whether to transmit or mute. Valid values are: RGR_ABS_TRANSMIT for a Pico eNB, RGR_ABS_MUTE for a Macro eNB.
WR_TAG_ABS_PATTERN	010101 010101 010101 010101 010101 010101 0101	40 milliseconds ABS pattern for FDD spanning over 4 subframes.
WR_TAG_ABS_LOAD_PERIODICITY	0	Periodicity of ABS pattern negotiation with peer eNodeBs. Value “0” is for OAM mode ABS pattern configuration.
WR_TAG_SFR_START_RB	25	Starting PRB of CE bandwidth. Range: 0 to 99.
WR_TAG_SFR_END_RB	49	Ending PRB of CE bandwidth. Range: 0 to 99.
WR_TAG_SFR_POWER_LOW	4	PA value used for Cell Centered UEs. ENUMERATED { dB-6, dB-4dot77, dB-3, dB-1dot77, dB0, dB1, dB2, dB3}

Parameters	Value	Description
WR_TAG_SFR_POWER_HIGH	5	PA value used for Cell Edge UEs. ENUMERATED { dB-6, dB-4dot77, dB-3, dB-1dot77, dB0, dB1, dB2, dB3}
WR_TAG_DEFAULT_PAGING_CYCLE	0	Default paging cycle value with range from 0 to 3.
WR_TAG_DEFAULT_PCCH_CFG_NB	7	Default PCCH_CFG_NB value with range from 0 to 7.
WR_TAG_DRX_ENABLED	0	Enable or disable the DRX functionality. Valid values are: 0 = Disable DRX feature (default). 1 = Enable DRX feature.
WR_TAG_DRX_INACTIVITY_TMR	0 to 21	DRX inactivity timer value. psf value is in number of PDCCH subframes. Value of psf1 corresponds to 1 PDCCH subframe. Recommended value is 4 Valid values are: 0 = psf1, 1 = psf2, 2 = psf3, 3 = psf4, 4 = psf5 (default), 5 = psf6, 6 = psf8, 7 = psf10, 8 = psf20, 9 = psf30, 10 = psf40, 11 = psf50, 12 = psf60, 13 = psf80, 14 = psf100, 15 = psf200, 16 = psf300, 17 = psf500, 18 = psf750, 19 = psf1280, 20 = psf1920, 21 = psf2560.

Parameters	Value	Description
WR_TAG_DRX_RETX_TMR	0 to 7	DRX retransmission timer value. psf value is in number of PDCCH sub-frames. Value of psf1 corresponds to 1 PDCCH subframe. Recommended value is 1 Valid values are: 0 = psf1, 1 = psf2 (default), 2 = psf4, 3 = psf6, 4 = psf8, 5 = psf16, 6 = psf24, 7 = psf33.

Parameters	Value	Description
WR_TAG_DRX_LONG_CYCLE	0 to 15	DRX long cycle value. sf value is in number of subframes. Value of sf10 corresponds to 10 subframes. Recommended value is 3 (40 milliseconds) Valid values are: 0 = sf10, 1 = sf20, 2 = sf32, 3 = sf40 (default), 4 = sf64, 5 = sf80, 6 = sf128, 7 = sf160, 8 = sf256, 9 = sf320, 10 = sf51,2 11 = s1f640, 12 = sf1024, 13 = sf1280, 14 = sf2048, 15 = sf2560. Recommended that the DRX long cycle is in multiples of 10 ms, in alignment with the CQI reporting periodicity 10, 20, 40, 80, and so on. The values 32, 64, 128, and so on are not recommended. The maximum recommended value for long DRX cycle is 3 (40 ms). Due to a limitation in L1, DRX does not decode two UE's CQI/RI report in the same TTI. Because of this limitation, when the DRX is enabled, the value of long cycle has direct impact on the number of UEs having unique DRX, CQI/RI offsets. For example, if long duration is 20 ms, the number of unique DRX, CQI/RI offsets possible is 20/2 = 10. Only 10 UEs get unique offsets. For the 11th UE, the offset must be reused resulting in CQI/RI decoding failure. Note: Do not to use the long DRX cycle values (10, 20) in this release.

Parameters	Value	Description
WR_TAG_DRX_LONG_CYCLE_GBR	1	DRX long cycle to be configured for a UE with GBR Bearers.
WR_TAG_DRX_LONG_CYCLE_NON_GBR	5	DRX long cycle to be configured for a UE with Non-GBR Bearers.
WR_TAG_ANR_DRX_LONG_CYCLE	0 to 15	ANR specific DRX long cycle value (default value is 11, which corresponds to sf640).
WR_TAG_ANR_DRX_ON_DURATION_TMR	0 to 15	ANR specific DRX on duration value (default value is 7, which corresponds to psf10).
WR_TAG_ANR_DRX_INACTIVITY_TMR	0 to 21	ANR specific DRX inactivity timer value. DRX inactivity timer value. psf value is in number of PDCCH subframes. Value of psf1 corresponds to 1 PDCCH subframe. 0 = psf1, 1 = psf2, 2 = psf3, 3 = psf4, 4 = psf5 (default), 5 = psf6, 6 = psf8, 7 = psf10, 8 = psf20, 9 = psf30, 10 = psf40, 11 = psf50, 12 = psf60, 13 = psf80, 14 = psf100, 15 = psf200, 16 = psf300, 17 = psf500, 18 = psf750, 19 = psf1280, 20 = psf1920, 21 = psf2560.
WR_TAG_MEAS_REPORT_REQ	1	Number of Measurement reports configuration.

Parameters	Value	Description
WR_TAG_BANDWIDTH	5, 10, 20	Bandwidth of 5 MHz, 10 MHz or 20 MHz respectively.
WR_TAG_BOOT_MODE	0	Booting mode selection.
WR_TAG_PRIMETWS_NO_BROADCAST	5	Default value for number of Primary ETWS broadcasts.
WR_TAG_PRIMETWS_REPETITION_PERIOD	10	Default value for Primary ETWS repetition period.
WR_TAG_PWS_ETWS_CMAS_CNTRL	0,1 and 2	PWS control for CMAS and ETWS. Valid values are: 0 = Disable PWS feature, 1 = Enable PWS feature, 2 = Enable PWS feature with CMAS.
WR_TAG_WATCHDOG_SOFT_LIMIT	5	Time period in seconds for the watchdog task to report a problem, if the context is not responding at least this often.
WR_TAG_WATCHDOG_HARD_LIMIT	15	Time period in seconds for the watchdog task to stop responding to the hardware watchdog, if the context is not responding at least this often eventually causing the system to reset.
WR_TAG_LOG_PATH	/var/log/	Path of the logging file to be stored.
WR_TAG_LOG_FILE	dbglog / stdout	Log file name. If file name is given as “stdout”, log framework prints the logs on console. Note: File name can be changed.
WR_TAG_LOG_MAX_FILES	5	Maximum number of log files to be created for storing.
WR_TAG_LOG_FILESIZE_LIMIT	10	Maximum file size limit in multiples of MB for each log file. When log file size exceeds the limit, new log file is created.
WR_TAG_LOG_LEVEL	3	There are 6 log levels. If log level is defined as 3, all logs with log level 1, 2 and 3 are logged in the log file. If log level is 1, then log with level 1 only is logged in the log file.
WR_TAG_LOG_MASK	[0] or [4,32,16]	Logging for particular module can be enabled by specifying the module name in the module mask. Logging for multiple modules can be enabled by giving comma separated module numbers.

Parameters	Value	Description
WR_TAG_LOG_PORT	9999	Remote application (post processor) port to connect to the eNB, collect live binary logs and display on console or re-direct to a file.
WR_TAG_LOG_REMOTE_LOGGING	0,1	Enable or disable remote logging. Valid values are: 0 = Disable remote logging (default), 1 = Enable remote logging.
WR_TAG_LOG_CIRBUF_SIZE	3000	Maximum size of circular buffer in multiples of 1 Kb or 1024 bytes.
WR_TAG_LOG_COREDUMP_FLAG	0,1	Generate core file or not. Valid values are: 0 = Generate core file (default), 1 = Do not generate core file.
WR_TAG_INT_FREQ_MEAS_GAP	1	Measurement gap configuration for Inter-frequency.
WR_TAG_ANR_MEAS_GAP_CONFIG	1	Measurement gap configuration for ANR.
WR_TAG_SRC_HO_CANCEL_TMR	400	Timer for HO at source
WR_TAG_NO_OF_EAID_INFO	1	Total number of Emergency Area ID Information.
WR_TAG_EAID_LIST_INFO	{1}	List of Emergency Area IDs.
WR_TAG_CNM_ENABLED	0,1	Enable or disable the CNM feature. Valid values are: 0 = Disable CNM feature (default), 1 = Enable CNM feature.
WR_TAG_CNM_BOARD_TYPE	1,2	CNM board type. Valid values are: 1 = EVM (default), 2 = DM2 and DM3.
WR_TAG_RRM_SR_PRDCTY	4	Index to the SR periodicity to be configured for the SR. Range is 0 to 6. Mapping with time in ms = {(0,5),(1,10),(2,20),(3,40),(4,80),(5,2),(6,1)}
WR_TAG_RRM_CQI_PRDCTY	5	Index to the CQI periodicity to be configured for the CQI. Range is 0 to 9. Mapping is = {(0,2),(1,5),(2,10),(3,20),(4,40),(5,80),(6,160),(7,32),(8,64),(9,128)}

Parameters	Value	Description
WR_TAG_RRM_NUM_SR_PER_TTI	4	Number of SR resources that can be scheduled per TTI. Range is 0 to 2047.
WR_TAG_RRM_NUM_CQI_PER_TTI	4	Number of CQI resources that can be scheduled per TTI. Range is 0 to 1176.
WR_TAG_RRM_N1_PUCCH	4	Number of resources reserved for N1PUCCH. Range is 1 to 8.
WR_TAG_DRX_QCI_SUPPORT_ENABLED	0,1	Parameter is used to configure DRX QCI. Value can be 0 or 1.
WR_TAG_SPS_ENABLE_FLAG	0,1	Enable or disable the SPS feature. Valid values are: 0 = Disable SPS feature (default), 1 = Enable SPS feature. **Note**: For value other than 1, the SPS feature is disabled.
WR_TAG_DL_NUM_SPS_UE_PER_TTI	1 to WR_TAG_DL_NUM_UE_PER_TTI	Maximum number of downlink SPS UE scheduling (for transmission or retransmission) per TTI. Minimum value = 1 (default), Maximum value = WR_TAG_DL_NUM_UE_PER_TTI. **Note-1**: This parameter is considered only if SPS feature is enabled. For invalid value, the value 1 is configured. **Note-2**: If value of WR_TAG_UL_NUM_PER_TTI is different from WR_TAG_DL_NUM_PER_TTI, then the minimum of two values is used since unidirectional SPS is not supported.
WR_TAG_UL_NUM_SPS_UE_PER_TTI	1 to WR_TAG_UL_NUM_UE_PER_TTI	Maximum number of uplink SPS UE scheduling (for transmission or retransmission) per TTI. Minimum value = 1 (default), Maximum value = WR_TAG_UL_NUM_UE_PER_TTI. **Note-1**: This parameter is considered only if SPS feature is enabled. For invalid value, the value 1 is configured. **Note-2**: If value of WR_TAG_UL_NUM_PER_TTI is different from WR_TAG_DL_NUM_PER_TTI, then the minimum of two values is used since unidirectional SPS is not supported.

Parameters	Value	Description
WR_TAG_MAX_SPS_RB	1 to 100	Maximum resource blocks allocated for SPS. Default value = 10. **Note**: If invalid value is provided, the value is configured as 50% of the cell resource blocks derived from the cell bandwidth (WR_TAG_BANDWIDTH).
WR_TAG_CSG_SMCELL_PCI_START	1	Start of small cell PCI range. The values can be 0 to 503. The configured serving cell PCI must be within this range when operating in open access mode. **Note**: eNodeB configuration does not enforce restriction on the small cell and CSG PCI range configuration. However, for proper network operation, the recommendation is to configure the CSG PCI range as subset of small cell PCI range.
WR_TAG_CSG_SMCELL_PCI_RANGE	100	Number of consecutive PCI values starting from WR_TAG_CSG_SMCELL_PCI_START. Values can range from 0 to 503. **Note**: The default small cell PCI range is from 1 to 6.
WR_TAG_CSG_HENB_NAME	"RADISYS"	HeNB name of the CSG. This is broadcasted to UE through System Information Block 9.
WR_TAG_DCFI_ENABLE	0	Enable or disable the Dynamic CFI. By default, remains disabled. Valid values are: 0 = Disable Dynamic CFI feature (default), 1 = Enable Dynamic CFI feature.
WR_TAG_CFI	1	Default value is 1 for 4 UE/TTI.
WR_TAG_PRACH_CONFIG_IDX	48	PRACH configuration index value to be used.
WR_TAG_RIM_CFG	{86400000, 5000, 5000, 5000, 2}	Configuration parameters for RIM. The parameter values are: 86400000 = RIM overall timer 5000 = RIM RIR timer 5000 = RIM RI timer 5000 = RIM RIAE timer 2 = Maximum retry count
WR_TAG_NUM_GERAN_NEIGH_FREQ	4	Number of neighbor GERAN frequencies.

Parameters	Value	Description
WR_TAG_GERAN_NEIGH_FREQ	{{1, 92, 2, 255}}	List of neighbor GERAN frequencies. The parameter values are: 1 = Band indicator 92 = ARFCN 2 = Cell re-selection priority 255 = NCC permitted
WR_TAG_GERAN_NEIGH_CELL	{{32020, 3, 4,63, 972, 1,92, 255, 0,0}}	List of neighbor GERAN cells. The parameter values are: 32020 = Neighbor PLMN 3 = LAC 4 = RAC 63 = BSIC 972 = Cell identifier 1 = Band indicator 92 = BCCH ARFCN 255 = NCC permitted 0 = DTM capable 0 = RIM support
WR_TAG_GERAN_MEAS_CFG	{2, 1, 1, 1000, 2100, 480}	GERAN measurement configuration. The parameter values are: 2 = GERAN report interval 1 = GERAN measurement allowed for CCO 1 = Is CCO Allowed 1000 = Measurement wait timer 2100 = T304 expiry wait timer value 480 = RRC data confirm wait timer value
WR_TAG_CELL_SIZE_TYPE	0	Indicates the cell size type. Valid values are: 0 = Very small 1 = Small 2 = Medium 3 = Large
WR_TAG_ARP_EMER_SERV	1	Default ARP value for Emergency services. Range: 1 to 15

Parameters	Value	Description
WR_TAG_GERAN_B2_RED_RSRP_THRSD1_VAL	70	b2-Threshold1 RSRP value for GERAN Redirection .
WR_TAG_GERAN_B2_RED_THRSD2_VAL	40	b2-Threshold2 RSSI value for GERAN Redirection.
WR_TAG_GERAN_B2_HO_RSRP_THRSD1_VAL	60	b2-Threshold1 RSRP value for GERAN SRVCC/Handover.
WR_TAG_GERAN_B2_HO_THRSD2_VAL	30	b2-Threshold2 RSSI value for GERAN SRVCC/Handover.
CFGEND	1	End of the configuration file.

7 Appendix – II

Traffic Generators

The performance testing for different scenarios is performed using the special commands as follows:

UDP Performance Testing

To collect the UDP performance data, execute the following commands.

Uplink Data

External Server side

iperf -s -u -i 1 -p 5000 –B <External Server IP address>

For example: iperf -s -u -i 1 -p 5000 –B 172.26.10.211

UE Client side

iperf -c <External Server IP address> -B <UE Client IP address> -u -i 1 -t 1000 -p 5000 -b 19m

For example: iperf -c 172.26.10.211 -B 172.26.10.xxx -u -i 1 -t 1000 -p 5000 -b 19m

Downlink Data

UE Client side

iperf -s -u -i 1 -p 9999 -B <UE Client IP address>

For example: iperf -s -u -i 1 -p 9999 -B 172.26.10.xxx

External Server side

iperf -c <UE Client IP address> -B <External Server IP address> -u -i 1 -t 1000 -p 9999 -b 23m

For example: iperf -c 172.26.10.xxx -B 172.26.10.211 -u -i 1 -t 1000 -p 9999 -b 23m

TCP Performance Testing

To collect the TCP performance data, execute the following commands.

Uplink Data

External Server side

iperf -s –w 128K -i 1 -p 5000 –B <External Server IP address>

For example: iperf -s –w 128K -i 1 -p 5000 –B 172.26.10.211

UE Client side

iperf -c <External Server IP address> -B <UE Client IP address> -i 1 -t 1000 -p 5000 –w 128K

For example: iperf -c 172.26.10.211 -B 172.26.10.xxx -i 1 -t 1000 -p 5000 –w 128K

Downlink Data

UE Client side

iperf -s –w 512K -i 1 -p 9999 -B <UE Client IP address>

For example: iperf -s –w 512K -i 1 -p 9999 -B 172.26.10.xxx

External Server side

iperf -c <UE Client IP address> -B <External Server IP address> -i 1 -t 1000 -p 9999 –w 512K

For example: iperf -c 172.26.10.xxx -B 172.26.10.211 -i 1 -t 1000 -p 9999 –w 512K

8 Appendix - III

Conversion of Binary logs into Readable Text format:

1. TeNB stores logs in binary format in a file.
2. To convert the logs from binary format to text format, use the following steps on linux machine.
   - Copy dbglog file from board present in the folder **/root/OAM/setup/trace/**
   - Copy **rlogapp** & **rlog.logdb** (available in the release package) in the same path where logs are copied.
   - Run the following command

     ./rlogapp –l rlog.logdb –b <dbgLog.*.bin log file> –o <logfileName.txt>

   Eg: ./rlogapp –l rlog.logdb –b dbglog_1970_1_1_0_2_17.bin –o log.txt

LIVE Streaming of TeNB Logs

To view live logs in text format from the remote server, use the following commands:

- Copy **rsys** folder to the remote server
- Goto **rsys/bin** path
- Run below command

  ./rlogapp -l rlog.logdb -i <Enodeb IP address> -p 9999

  Eg: ./rlogapp –l rlog.logdb –i 172.27.40.25 –p 9999

Log Level:

The Log level can be set in the config file or can be dynamically changed**.** By default log level is 4, means **EVENT**. The log level range is 1 to 6.

Below are the Tags to set Log Level in comfig file.

LTE_ENB_L3LOG_LEVEL -- This is used to set Radisys L3 Stacks logs level

LTE_ENB_L2LOG_LEVEL -- This is used to set Radisys L2 Stacks logs level

Please use the below commands from OAM Cli to dynamically set the Log Level

1. oam.set LTE_ENB_L3LOG_LEVEL <logLevel>
2. oam.set LTE_ENB_L2LOG_LEVEL <logLevel>

Generation of rlog.logdb:

For Qcom the logdb for L3(l3.logdb) and L2(l2.logdb) are generated separately during their respective compilation. Please follow the below steps to generated the consolidated logdb(rlog.logdb)

- Ensure both L2 and L3 compilation is done
- Go to eNodeB compilation directory

  cd BUILD_ROOT/fsm99xx_ltel2/app/rsys/build
- Run the below script to generate common rlog logdb file

  sh genCmnRlogdb.sh

The rlog.logdb will generated and will be copied to **BUILD_ROOT/fsm99xx_ltel2/app/rsys/build/rsys/bin/**

9 References

Refer to the following documents for additional information in the provided software package.

[1]. TeNB_REM_User_Guide_1222465.pdf

[2]. TeNB_OAM_User_Guide_1222464.pdf

[3]. TeNB_FSM9955_TDD_Release_Notes_1225337.pdf

[4]. Polaris EPC Installation Guide.docx

10 Definitions and Acronyms

Acronym	Description
3GPP	3rd Generation Partnership Project
ANR	Automatic Neighbor Relations
APN	Access Point Network
App	Sample Application Layer
ATCA	Advanced Telecom Computing Architecture
BCCH	Broadcast Control Channel
BSP	Bicriterion Shortest Path
CLI	Command Line Interface
CMAS	Commercial Mobile Alert System
CN	Core Network
CNE	Core Network Emulator
CNM	Continuous Network Monitoring
CPU	Central Processing Unit
CQI	Channel Quality Indicator
DL	Downlink
DLPC	Downlink Power Control
DRB	Data Radio Bearer
DRX	Discontinuous Reception
DTCH	Dedicated Traffic Channel
ECGI	E-UTRAN Cell Global Identifier
e-GTP	Evolved GTP
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
eNB or eNodeB	E-UTRAN Node B
EPC	Evolved Packet Core

Acronym	Description
EPS	Evolved Packet System
E-RAB or ERAB	E-UTRAN Radio Access Bearer
ETWS	Earthquake and Tsunami Warning System
E-UTRAN	Evolved UTRAN
EVM	Error Vector Magnitude
DM	Dual Mode
FDX	Full Duplex
FGI	Feature Group Indicator
GTP	GPRS Tunneling Protocol
HARQ	Hybrid ARQ
HeMS	Home eNodeB Management System
HSS	Home Subscriber Server
IE	Information Element
IKEv2	Internet Key Exchange v2
IMSI	International Mobile Subscriber Identity
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IPsec	IP Security
LA	Link Adaptation
L-ARM or LARM	Lower ARM
LCG	Logical Channel Group
LTE	Long Term Evolution
MAC	Medium Access Control Protocol
MCC	Mobile Country Code
MIB	Master Information Block

Acronym	Description
MME	Mobile Management Entity
MNC	Mobile Network Code
MTU	Maximum Transmission Unit
NAS	Non-access Stratum
NMM	Network Monitor Mode
NR	Neighbor Relation
NRT	Neighbor Relation Table
OAM	Operation And Maintenance
ODMA	Opportunity-Driven Multiple Access
OPC	Operations Controller
PCI	Physical Cell Identifier
PDB	Packet Delay Budget
PDCCH	Physical Downlink Control Channel
PDCP	Packet Data Convergence Protocol
PDN	Packet Data Network
PDSCH	Physical Downlink Shared Channel
PDU	Protocol Data Unit
PFS	Proportional Fair Scheduler
PUSCH	Physical Uplink Shared Channel
P-GW or PDN-GW or PGW	PDN Gateway
PLMN	Public Land Mobile Network
PWS	Public Warning System
QPSK	Quadrature Phase Shift Keying
QXDM	Qualcomm Extensible Diagnostic Monitor
RAB	Radio Access Bearer
RAC	Radio Admission Control

Acronym	Description
REM	Radio Environment Monitoring
RF	Radio Frequency
RLC	Radio Link Control Protocol
RNC	Radio Network Controller
RRC	Radio Resource Control Protocol
RRM	Radio Resource Management
RV	Redundancy Version
S1AP	S1 Application Protocol
SCTP	Stream Control Transmission Protocol
S-GW or SGW	Serving Gateway
SDU	Service Data Unit
SIB	System Information Block
SINR	Signal to Noise Ratio
SM	Stack Manager
SoC	System-on-a-Chip
SON	Self-Organizing Network
SPS	Semi-Persistent Scheduling
SRVCC	Single Radio Voice Call Continuity
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
TCP	Transmission Control Protocol
TDD	Time Division Duplex
TeNB or TOTALeNB	TOTALeNodeB
TFTP	Trivial File Transfer Protocol
TTI	Transmission Timing Interval
TUCL	TCP/UDP Convergence Layer

Acronym	Description
TM	Transmission Mode
U-ARM or UARM	Upper ARM
U-Boot	Universal Boot Loader
UDP	User Datagram Protocol
UE	User Equipment
UL	Uplink
ULPC	Uplink Power Control
USB	Universal Serial Bus
UTRAN	Universal Terrestrial Radio Access Network
VC	Video Client
VS	Video Server
X2AP	X2 Application Protocol

www.radisys.com