



LTE TOTALeNodeB TDD Solution
On Qualcomm FSM9955
Release Notes - 5.0 GA
1225337 1.0

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1 Preface

1.1 Objective

The objective of this document is to provide the release information of the LTE TOTALeNodeB (TeNB) TDD Solution 5.0 GA release on Qualcomm FSM9955 platform. This document also describes the supported features, capabilities, and components of TeNB.

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
- Existing and potential customers

The readers must have an understanding of TeNB and the architecture.

1.3 Document Organization

This document contains the following sections.

Table-1: Document Organization

Section	Description
1. Preface	Provides the objective and release details.
2. Introduction	Provides an overview of the product.
3. TOTALeNodeB Features	Lists the product features supported, added and validated.
4. Test Result Summary	Provides the performance and stability numbers achieved for this release.
5. Component Versions	Lists the supported components and version details for this release.
6. Limitations	Lists the limitations in this release.
7. Open Issues	Lists the open issues in this release.
8. Deliverables	Lists the deliverables and documents packaged along with this product.
9. Interoperability	Lists the equipment or devices used for testing the TeNB product.
10. Definitions and Acronyms	Lists the definitions and acronyms used in this document.

1.4 Release History

Table-2 lists the history of changes in successive revisions to this document.

Table-2: Release History

Version	Date	Description
1.0	Dec 15, 2016	LTE TeNB GA 5.0 TDD Solution on Qualcomm FSM9955 platform
0.3	Oct 15, 2016	Release Notes for LTE TeNB 5.0 EA TDD Solution on Qualcomm FSM9955 platform
0.2	Sep 15, 2016	Release Notes for LTE TeNB MS3 TDD Solution on Qualcomm FSM9955 platform
0.1	Aug 15, 2016	Preliminary document for LTE TeNB MS2 TDD Solution on Qualcomm FSM9955 platform

2 Introduction

2.1 Product Description

Radisys TOTALeNodeB (TeNB) is an LTE eNodeB Solution designed and productized for Small Cell deployments on Qualcomm FSM9955 TDD platform. TeNB is a comprehensive small solution with integrated RRM, SON, and OAM on leading SoC platforms optimized for performance.

For more description about Radisys TeNB product and features, refer *TeNB_Solution_Functional_Specification_1091606.pdf* document.

3 TOTALeNodeB Features

The scope of the product features for the 5.0 GA release version is outlined as follows.

3.1 Management

1. TR-069 based standards for configuration (TR-181, TR-196, TR-262 and TR-157)
2. Upgrade of data model to TR-181 Amendment 2
3. Support for eNB IP Address Reconfiguration
4. Dynamic Configuration Update of neighbor frequency and neighbor cell from HeMS.
5. Fault and performance management
6. Layer-3 Counters (RRC and S1AP)
7. Layer-2 Counters (MAC & RLC, PDCP)
8. Integrated and tested with RadiSys OAM
9. Interface to integrate 3rd party OAM implementation
10. Error monitoring and recovery: Watchdog Timer to monitor all TeNB processes and recovers from crash, hang, stall, or loop situations.
11. Additional compliance to TR-181 and TR-196 data models
12. IPSec tunnel management with auto connect upon connection failure
13. Support for TR-111
14. Software upgrade

3.2 Radio Interface

1. Broadcast of MIB and SIBs (SIB1, SIB2, SIB3, SIB4, SIB5, SIB6, SIB8, SIB9, SIB10, SIB11, and SIB12)
2. DL and UL HARQ (support for 8 HARQ processes)
3. 2x2 MIMO with 5 MHz, 10 MHz, 15MHz, and 20 MHz Channel Bandwidth
4. Link Adaptation based on BLER (DL and UL)
5. Layer-2 Measurement Counters
6. DRX for improved batter performance(Long and Short DRX)
7. Disabling of DRX for QCI Bearers 1, 2, 3 and 4
8. Transmission modes – TM1, TM2 and TM3
9. Power control of PUSCH, PUCCH
10. UL timing alignment
11. Release-10 RRC compliance to 3GPP technical specification RRC protocol (3GPP TS 36.331). The upgrade does not add any new feature, but enhances the existing features of TeNB solution for Release-10 compliance.
12. DCFI: This feature supports dynamic change of Control Format Indicator (CFI) based on the Control Channel Element (CCE) usage for PDCCH allocation of the UEs connected to the eNodeB. It allows system to use low CFI value when PDCCH usage is low and high CFI value when PDCCH usage is high.

13. Semi Persistent Scheduling: This feature supports semi persistent scheduling of VoIP calls on QCI-1 bearer and also supports the TDD specific parameter 'twoIntervalCfg'.
14. DLFSS: This release supports Downlink Frequency Selective Scheduling (DLFSS), which performs Channel Aware Scheduling in Downlink using sub-band based CQI reports from the UE. The PUCCH CQI reporting mode 2-0 and PUSCH Aperiodic CQI reporting mode 3-0 are configured to derive Channel State Information.
15. Release-11 RRC compliance: This release contains an upgrade of the TeNB solution to support Release-11.11.0 (Mar 2015) version of 3GPP technical specification RRC protocol (3GPP TS 36.331). The upgrade does not add any new feature, but enhances the existing features of TeNB solution for Release-11 compliance
16. OAM provisioning for DL Transmission Mode selection
17. Support for DL Transmission Mode 4
 - a. Support for periodic CQI reporting modes 1-1 and 2-1 and aperiodic CQI reporting mode 3-1.
 - b. Enhancements to DL Link Adaptation and DL frequency selective scheduling for TM 4 UEs.

3.3 Network Interfaces (S1 and X2)

1. S1AP:
 - a. S1 Setup Procedure
 - b. MME Configuration Update Procedure
 - c. Reset Procedure
 - d. TeNB Configuration Update Procedure
2. X2AP:
 - a. X2 Setup Procedure
 - b. TeNB Configuration Update Procedure
3. Tracking Area Update Procedures
4. MME Selection (S1 Flex)
5. Network Elements (MME, eNB) Monitoring using Heartbeat messages
6. Peer SCTP Multi-homing
7. Handling of S1-U Error Events
8. Release-10 S1AP compliance to S1AP (3GPP TS 36.413) Release-10.5.0 (July 2012). Enhances the interoperability of TeNB solution with MME and SGW that are compliant to Release-10 specification. The upgrade does not add any new feature, but enhances the existing features of TeNB solution for Release-10 compliance.
9. Release-10 X2AP compliance
 - a. The release contains an upgrade of the TeNB solution to support Release-10.5.0 (July 2012) version of 3GPP technical specification for X2AP (3GPP TS 36.423). The upgrade enhances the interoperability of TeNB solution with other eNodeB that are compliant to Release-10 specification.
 - b. **Note:** The upgrade does not add any new feature, but enhances the existing features of TeNB solution for Release-10 compliance.
10. IPV6 support on S1 Interface, S1-u interface and X2 Interface.

11. Release-11 S1AP compliance to 3GPP technical specification for S1AP (3GPP TS 36.413). Enhances the interoperability of TeNB solution with MME and SGW that are compliant to Release-11 specification. The upgrade does not add any new feature, but enhances the existing features of TeNB solution for Release-11 compliance.
12. Release-11 X2AP compliance to 3GPP technical specification for X2AP (3GPP TS 36.423). The upgrade enhances the interoperability of TeNB solution with other eNodeB that are compliant to Release-11 specification. The upgrade does not add any new feature, but enhances the existing features of TeNB solution for Release-11 compliance.

3.4 Mobility

1. Intra-LTE Handover with Data Forwarding in UL and DL
 - a. Intra-frequency and Inter-frequency S1 Handover
 - b. Intra-frequency and Inter-frequency X2 Handover
 - c. UE History Information (UHI): The UHI feature supports information collection and storage related to an UE in a connected state of the cells visited by that particular UE.
2. Mobility to UMTS
 - a. Redirection to WCDMA (UTRA) with/without UE Measurements (without SI)
 - b. Redirection to TD-SCDMA based on Measurement Reports
 - c. IRAT Handover to WCDMA
3. Circuit Switched Fallback (CSFB) to UMTS with redirection: CSFB to WCDMA and TD-SCDMA 1.28Mcps RATs via redirection using RRC Connection Release with and without SI
4. CSFB to GERAN
 - a. CSFB to GERAN via redirection using RRC Connection Release with and without SI.
 - b. CSFB to GERAN via cell change order with NACC.
 - c. CSFB to GERAN with redirection with and without SI
5. eCSFB to CDMA 1xRTT with & without Redirection to CDMA network with UE measurements.
6. RIM for UTRAN and GERAN SI

RIM protocol allows the exchange of information (for example, request and transfer of GERAN or UTRAN system information) between two RAN nodes via the core network. The system information fetched using RIM protocol is used during CSFB to GERAN or UTRAN.
7. Handover Restriction List (HRL): The HRL feature identifies roaming area and access restrictions for handover and CSFB. In networks that support E-UTRAN network sharing, the HRL provided by the core-network to the radio access network (RAN) is also used to inform the selected PLMN and equivalent PLMNs to the RAN.
8. Support for redirection to GERAN when UE is leaving LTE coverage using measurements to detect the best GERAN neighbor.
9. Support for SRVCC (CS only) HO to GERAN RAT if redirection is not configured.
10. Support for SRVCC as part of HO to WCDMA RAT (CS Only or CS and PS HO).
11. Mobility or HO between hybrid mode of operation and other modes of operation.

3.5 QoS

1. Proportional Fair Scheduler (PFS) for MAC Scheduling

2. RR scheduler
3. Support for configurability to choose scheduling behavior.
4. Support for QoS-compliant Round-Robin and Max C/I Packet Schedulers.
5. Support for Packet Delay budget.
6. Support traffic shaping in UL based on the configured bit rates for the bearers.
7. Dynamic resource allocation of Physical resources for Hybrid Access Mode.
8. Support for UE context modification for CSG membership subscription status.

3.6 RRM

1. Radio Resource Configuration
2. Call Admission Control
3. Redirection of UEs on reaching the threshold of maximum simultaneous users
4. Access Class Barring (ACB)
5. Configurability of maximum threshold for PRB usage of GBRs.
6. Radio Bearer Control (RBC) using ARP, QCI and CSG status during creation, modification and handover of sessions.
7. Support for Call Admission Control (CAC) additionally using CSG status.
8. Support to re-direct users to a different frequency or different RAT when it is not able to service the user.
9. Radio Resource Congestion detection and control for GBRs.
10. Configurability to turn on or turn off ACB.
11. Configurability of Special Access Class of users allowed to use the system when ACB is turned on.

3.7 SON

1. Automatic Neighbor Relation (ANR)
 - a. Periodic ANR
 - b. Event based ANR with A3 measurement for Intra-frequency
 - c. Event based ANR with A5 measurement for Inter-frequency
2. Radio Environment Monitoring (REM) / Networking Monitoring Module (NMM)
3. Self-Optimizing Network (SON) module supports the following features
 - a. PRACH configuration parameter selection during cell bring up
 - b. DL-EARFCN selection during cell bring up
 - c. PCI selection during cell bring up
 - d. PCI collision prevention
 - e. PCI confusion detection and correction
4. SON PCI self-configuration for hybrid mode of operation and boot-up TPM.

3.8 Security

1. SNOW3G Integrity and Ciphering Algorithms

2. IPSec towards S1 interface
3. Support for configuration of ZUC Integrity and Ciphering algorithm.

3.9 Logging

1. Support for Binary Logging in L2 and L3.
2. Support configuration of log file sizes and file rotation.
3. Support for log levels based on Severity.

3.10 Periodic REM

Support to scan the LTE neighbor cells periodically through REM

3.11 Performance and Capacity

1. 32 connected and active UEs
2. Peak data rates for 20MHz 2x2 MIMO configuration
3. Up to 2 UEs or TTI for both UL and DL

3.12 UE Procedures

1. E-RAB Procedures (Setup, Modify and Release)
2. UE Location Reporting
3. Commercial Mobile Alert System (CMAS)
4. Earthquake and Tsunami Warning System (ETWS)
5. GTP-U Error Indication
6. Open Access Mode

3.13 Others

1. Support for average and maximum CPU counters for each measurement interval.
2. Support for current and maximum memory usage counters for each region and pool maintained by Radisys memory management.
3. Support for current and maximum memory usage counters for each pool of the platform packet memory.

4 Test Result Summary

4.1 Feature Validation Summary

The feature validation summary for this release are:

- The features mentioned in Section 3 are fully validated except the ones mentioned in Table-3.
- Some of the features in Table-3 are partially validated with details mentioned in the comment column.
- Existing or legacy features mentioned in Section 3 are validated to ensure zero regression.

Table-3: Feature Validated

No.	Feature	Comment
1	SRVCC	This feature is unit tested. End-to-end test is not performed.
2	Release 11	This feature is unit tested. End-to-end test is not performed.
3	Circuit Switched Fallback with and without SI	This feature is unit tested. End-to-end test is not performed.
4	Re-direction to TD-SCDMA	This feature is unit tested. End-to-end test is not performed.
5	eCSFB to CDMA 1xRTT with or without UE Measurements	This feature is unit tested. End-to-end test is not performed.
6	IRAT Handover to WCDMA	This feature is unit tested. End-to-end test is not performed.

4.2 Performance Test and Stability Results

The performance and stability tests achieved for this release are completed with the following conditions:

1. The tests are manually stopped.
2. The Over-The-Air (OTA) tests are performed using Cat-4 UE.

4.2.1 Stability

The call models mentioned in Table-4 are verified with 32 UEs for more than 24 hours at maximum throughput (as mentioned in Section 4.2.2).

Table-4: Call Models

S.No.	Call Model
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1	Attach – FTP-FDX – Detach (short call)
2	TCP-FDX with different window sizes (long call)
3	FTP-FDX over non-GBR bearer
4	UDP-FDX over GBR bearer
5	Mix of above traffic scenarios across different UEs

4.2.2 Performance

The performance results for configuration modes 1 and 2 (CM1 and CM2) for 1 and 32 UEs, 2x2 MIMO over 1 hour duration are given in the following table.

4.2.2.1 TDD UL/DL Configuration Mode 1

Use Case	2 UEs per TTI		4 UEs per TTI	
	Throughput in Mbps	CPU Utilization	Throughput in Mbps	CPU Utilization
1 UE, 20 MHz, FTP- Full Duplex	63.96/16.66	cpuUsage 21.8 avgCpuUsage 17.7 maxCpuUsage 46.6	68.25/16.12	cpuUsage 21.7 avgCpuUsage 22.6 maxCpuUsage 30.4
32 UE, 20 MHz, FTP-Full Duplex	63.15/13.01	cpuUsage 7.5 avgCpuUsage 7.7 maxCpuUsage 46.6	63.19/14.7	cpuUsage 7.76 avgCpuUsage 7.9 maxCpuUsage 30.4

4.2.2.2 TDD UL/DL Configuration Mode 2

Use Case	2 UEs per TTI		4 UEs per TTI	
	Throughput in Mbps	CPU Utilization (Krait, Hexagon)	Throughput in Mbps	CPU Utilization (Krait, Hexagon)
1 UE, 20 MHz, FTP- Full Duplex	89.45/6.15	cpuUsage 22.2 avgCpuUsage: 25.6 maxCpuUsage: 66.4	102.65/5.32	cpuUsage 7.3 avgCpuUsage 7.5 maxCpuUsage 66.4

32 UE, 20 MHz, FTP-Full Duplex	81.93/6.02	cpuUsage: 7.98 avgCpuUsage: 7.9 maxCpuUsage: 66.4	103.51/6.87	cpuUsage 7.7 avgCpuUsage 7.8 maxCpuUsage 66.4
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4.3 Handover Test Results

Table-5 lists the handover test results achieved for this release.

Table-5: Handover Test Results

Use Case	MIMO, 4 UEs per TTI, PFS Scheduler, Bandwidth-20 MHz		
	Scenario (TM500 with Disable DRX)	Successful Hops / Number of Hops	Success Rate
32 UE, S1 Inter-frequency HO	Ping data	10355/10355	100%
32 UE, X2 Inter-frequency HO	TCP DL and Ping Data	1044/1044	100%
Intra S1HO Multi UE	UDP Data	6164/6187	99.62%
Intra X2 HO Multi UE	Ping data	3432/3432	100%

5 Component Versions

The following table describes the version details for the different components of the LTE TeNB Solution.

Component	Release Name	Provider	Included in Radisys Package
Radisys TOTALeNodeB	5.0 GA on Qualcomm TDD Label: TENB_FSM9955_TDD_GA_5.0.0_REL	Radisys	Yes
Qualcomm TDD PHY (L1) and BSP	PP 6.7.1	Qualcomm	No
Type of Device	FSM9955 TDD	Qualcomm	No

6 Limitations

Table-6 lists the limitations for this 5.0 GA release.

Table-6: Limitations

S.No.	Description	Comments / Status
1.	New UTRA band XXXII configuration from OAM	The new band added in Release-10 is unused and un-configurable from OAM because there is no available frequency. This is a RRC Release-10 requirements limitation and is a place holder in the specification for future use.
2.	SCTP Multi-Homing supports up to 4 secondary IP addresses for a peer	When an SCTP peer transmits more than four secondary IP addresses in an INIT-ACK, SCTP stores a maximum of four secondary IP addresses and the remaining are discarded. Consequently, association can go down when any data or SCTP heartbeat is received from the dropped addresses.
3.	eNodeB can handle a maximum of 900 bytes of CMAS warning content	Improvements in progress to allow eNodeB to handle more than 900 bytes.
4.	SPS Feature	SPS feature is not supported by Qualcomm PHY.
5.	IPSec	Data with IPSec is not tested due to BSP limitation.
6.	Run time support for configuration of TDD configuration mode 1 and 2 is not supported.	Tested TDD Configuration mode 1 by changing in rfmgrProcess.
7.	Kernel watchdog	Kernel level watchdog is not supported. Software level watchdog is supported.

7 Open Issues

List of open issues for this 5.0 GA release.

7.1 Open issues pending Qualcomm Support.

Below Table lists the open issues for this 5.0 GA release waiting on Qualcomm.

S.No.	Description	Comments / Status
1.	Error Trap "IPC_FIFO_BUFFER_ADDR_IS_NOT_ALLOC" (10279) in the DL IPC FIFO module.	This is observed during 32 UEs stability testing with high throughput. Added workaround to avoid corruption in IPC FIFO.
2.	Kernel panic while running data	This is observed during 32 UEs stability testing with high throughput.
3.	Error traps MSG_QUEUE_OVERFLOW(2054) and MSG_BUFFER_ALLOC(2066)	Error traps observed with throughput testing when DLFSS is enabled
4.	Error Indication for DL_CONFIG_REQ with error code 213	Issue is observed only in PP_6.7.1. Waiting for Qualcomm response.
5.	Support for Kernel watchdog	Current BSP does not support kernel watchdog. Askey has shared new BSP and suggested to implement to integrate with kernel watchdog.

7.2 Open issues

Below table lists the open issues for this 5.0 GA release waiting on Radisys.

S.No.	Description	Comments / Status
1.	L2 crash observed in " cmPktFuPucchDeltaPwr"	This issue is observed in L2 during UDP UL and FTP DL, 10 MHz scenario. Debugging is in progress.
2.	Scheduler cell configuration failed when NumberOfRaPreambles set to 64 during Admin toggle operation	Its base code issue in oam configuration.
3.	eNB configures UTRA measurement object incase Utran is added as forbidden RAT or all the cells do not support the serving or equivalent PLMN specified in HRL	Its base code issue.

4.	KPI Files not uploading as per the OAM configuration.	Its base code issue in OAM.
5.	After adding the dynamic EUTRA neighbor, dbg log showing deleting the neighbor print	Its base code issue.
6.	With 5 MHz, L2 crash observed upon disabling CFI flag dynamically during 32 UE TCP DL data on going	Debugging is in progress.
7.	L2 crash at target eNB during x2 Intra handover with multi Ues	Debugging is in progress.
8.	Throughput degradation observed when enabled DCFI feature flag dynamically when 32 UEs TCP FDX on going	Its base code issue.
9.	eNB considering HRL even though emergency bearer is present	Its base code issue.
10.	eNB does not include report config id for A5 ANR if there is emergency bearer and HRL in ICS Request	Its base code issue.

8 Deliverables

The following deliverables are provided as part of the LTE TeNB Solution.

1. TeNB_FSM9955_TDD_User_Guide_1222337.pdf
2. TeNB_FSM9955_TDD_Release_Notes_1225337.pdf
3. TeNB_Solution_Functional_Specification_1091606.pdf
4. TeNB_OAM_Integration_Guide_1555464.pdf
5. TeNB_OAM_User_Guide_1222464.pdf
6. TeNB_NMM_REM_API_Definition_1100103.pdf
7. TeNB_RRM_API_Definition_1100104.pdf
8. OAM_Compliance.xlsm
9. TeNB_FSM9955_TDD_High_Level_Design.pdf
10. TeNB_FSM9955_TDD_Conformance_Verification_Plan.pdf
11. TeNB and OAM source code and binaries (including REM and watchdog)

9 Interoperability

9.1 Equipment or Device

Vendor	Model	Band
Samsung	Samsung Note-4	40
LG	LG Nexus	40
Aeroflex (Simulator)	TM500	40
Accuver	DM Tool	UE controller and log analyzer

9.2 EPCs

Vendor	Version
Polaris EPC	11.1.0.5 and above

10 Definitions and Acronyms

Table-7 lists the definitions and acronyms used in this document

Table-7: Acronyms and Abbreviations

Acronym	Description
1XRTT	1 Times Radio Transmission Technology
3GPP	3 rd Generation Partnership Program
ABS	Almost Blank Sub frames
ACB	Access Class Barring
ANR	Automatic Neighbor Relation
API	Application Programming Interface
ASN.1	Abstract Syntax Notation One
BLER	Block Error Rate
BW	Bandwidth
CCE	Control Channel Element
CCO	Cell Change Order
CDMA	Code Division Multiple Access
CFI	Channel Format Indicator
CM1	Configuration Mode 1
CM2	Configuration Mode 2
CMAS	Commercial Mobile Alert System
CN	Core Network
CNE	Core Network Emulator
CNM	Continuous Network Monitoring
CPU-L	Central Processing Unit- Lower
CPU-H	Central Processing Unit-Upper
CQI	Channel Quality Indicator
CS	Circuit Switched

Acronym	Description
CSFB	Circuit Switched Fallback
CSG	Closed Subscriber Group
DB	Database
DCFI	Dynamic Control Format Indicator
DCI	Downlink Control Information
DiffServ	Differentiated Services
DIP	Dynamic IP
DL	Downlink
DLFSS	Downlink Frequency Selective Scheduling
DRX	Discontinuous Reception
DSP	Digital Signal Processor
DSCP	Differentiated Services Code Point
EA	Early Access
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
eCSFB	Enhanced Circuit Switched Fallback
EDGE	Enhanced Data-rates for GSM Evolution
eGTP	Evolved GTP
eMBMS	LTE Evolved Multimedia Broadcast Multicast Service
eNB/eNodeB	Evolved NodeB
EPC	Evolved Packet Core
ERAB / E-RAB	E-UTRAN Radio Access Bearer
ETWS	Earthquake Tsunami Warning System
E-UTRAN	Evolved UTRAN
FCC	Federal Communication Commission
FDD	Frequency Division Duplex
FDX	Full Duplex

Acronym	Description
FSM	Femtocell Station Modem
FTP	File Transfer Protocol
GA	General Access
GBR	Guaranteed Bit Rate
GERAN	GSM EDGE Radio Access Network
GPS	Global Positioning System
GSM	Global System for Mobile Communication
GTP	GPRS Tunneling Protocol
HDX	Half Duplex
HeMS	Home eNodeB Management System
HeNB	Home eNodeB
HO	Handover
HRL	Handover Restriction List
IE	Information Element
IKE	Internet Key Exchange
IP	Internet Protocol
IPSec	IP Security
IRAT / I-RAT	Inter-Radio Access Technology
IWS	Interworking Solution
L1	Layer 1
L2	Layer 2
L3	Layer 3
LTE	Long Term Evolution
MAC	Medium Access Control Protocol
Mbps	Megabits per second
Mcps	Megachips Per Second

Acronym	Description
MIB	Master Information Block
MIMO	Multiple Input Multiple Output
MME	Mobile Management Entity
MPLS	Multiprotocol Label Switching
NACC	Network-Assisted Cell Change
NMM	Network Monitoring Mode
OAM	Operations, Administration, and Maintenance
OTA	Over The Air
PCI	Physical Cell Identity
PDCCH	Physical Downlink Control Channel
PDCCP	Packet Data Convergence Protocol
PDB	Packet Delay Budget
PFS	Proportional Fair Scheduler
P-GW/PDN-GW/PGW	PDN Gateway
PHB	Per Hop Behavior
PLMN	Public Land Mobile Network
PRACH	Physical Random Access Channel
PRB	Physical Resource Block
PS	Packet Switched
PSI	Packet System Information
PUCCH	Physical Uplink Control Channel
PUSCH	Physical Uplink Shared Channel
PWS	Public Warning System
QA	Quality Assurance
QCI	QoS Class Identifier
QoE	Quality of Experience

Acronym	Description
QoS	Quality of Service
RACH	Random Access Channel
RAN	Radio Access Network.
RAND	Random Number
RAT	Radio Access Technology
REM	Radio Environment Monitoring
RIM	RAN Information Management
RLC	Radio Link Control
RNC	Radio Network Controller
RNTI	Radio Network Temporary Identifier
ROHC	Robust Header Compression
RR	Round Robin
RRC	Radio Resource Control
RTT	Round-Trip Time
RRM	Radio Resource Management
RX	Reception / Receive
S1AP	S1 Application Protocol
SCTP	Stream Control Transmission Protocol
SDU	Service Data Unit
SFN	Subframe Number
SGSN	Serving GPRS Support Node
S-GW/SGW	Serving Gateway
SI	System Information
SIB	System Information Block
SM	Stack Manager
SN	Sequence Number

Acronym	Description
SoC	System on a Chip
SON	Self-Organizing Network
SPS	Semi Persistent Scheduling
SRS	Software Requirements Specification
SRVCC	Single Radio Voice Call Continuity
TDD	Time Division Duplexing
TD-SCDMA	Time Division Synchronous Code Division Multiple Access
TeNB / TOTALeNB	TOTALeNodeB
TM	Transmission Mode
TPC	Transmit Power Control
TPM	Transmit Power Management
TTI	Transmission Time Interval
TUCL	TCP/UDP Convergence Layer
TX	Transmission / Transmit
UE	User Equipment
UHI	UE History Information
UL	Uplink
UM	Unacknowledged Mode
UMTS	Universal Mobile Telecommunications System
UTRAN	Universal Terrestrial Radio Access Network
VoIP	Voice over Internet Protocol
WCDMA	Wideband Code Division Multiple Access
WWW	World Wide Web
X2AP	X2 Application Protocol

For a list of commonly used terms, refer to the Engineering Glossary at www.radisys.com/resources/wireless-glossary/



www.radisys.com