

- ☞ Tests eNodeB functionality and eNodeB conformance to 3GPP standards
- ☞ Targeted at eNodeB equipment manufacturers, eNodeB software vendors and operators
- ☞ Tests all eNodeB interfaces both concurrently and separately
- ☞ Enables negative testing and test creation based on specific usage scenario
- ☞ Test scripts written in Tcl (available in source form)
- ☞ Windows based GUI with multi pane window for protocol message decoding, message sequence charting and event logging
- ☞ Command line interface for automated unattended mode of operation
- ☞ Ability to create batch files by selecting any number of tests for batch operation
- ☞ PDU Level of control provided

The Polaris LTE eNodeB Functional Tester is part of the family of LTE Functional Testers from Polaris Networks. The eNodeB Functional Tester tests if an LTE eNodeB is implemented in compliance to 3GPP TS 36.321 (Medium Access Control), TS 36.322 (Radio Link Control), TS 36.323 (Packet Data Convergence Protocol), TS 36.331 (Radio Resource Control), TS 36.423 (X2 Application Protocol), TS 36.413 (S1 Application Protocol), and other relevant 3GPP standards.

The eNodeB provides the access to user equipment to the LTE Network. eNodeB is the key control-node for the LTE access-network. It is of critical importance to LTE equipment manufacturers and also to service providers to verify if an eNodeB implements relevant 3GPP protocol specifications correctly.

Apart from verifying an eNodeB implementation for compliance to functional requirements specified by 3GPP, eNodeB Functional Tester is also useful as a regression tool for eNodeB manufacturers as the tester offers a wide coverage of tests and is completely automated.

The components of a functional test suite are the Test Suite Structure and Test Purposes (TSS & TP) document, the Abstract Test Suite that includes the functional test scripts specified using Tcl and the Test Platform on which the test scripts are executed.

The Test Suite Structure and Test Purposes (TSS & TP) document created by Polaris Networks for eNodeB functional testing, is based on 3GPP protocol specifications for the eNodeB and the surrounding LTE network elements.

The eNodeB Functional Tester emulates all the entities adjacent to the eNodeB, i.e. MME, S-GW and eNodeB. It uses UE Simulator platforms from other vendors to simulate the UE. The tester then creates the test conditions using all of the eNodeB interfaces to test the response of the eNodeB. It tests the LTE Uu (UE-eNodeB), S1-MME (eNodeB-MME), S1-u (eNodeB-S-GW), and X2 (eNodeB-eNodeB) interfaces of the eNodeB. The functional test cases cover all critical procedures, e.g. UE Attach, Detach, Handover, Paging, Tracking Area Updates, etc.

## TEST BED SETUP

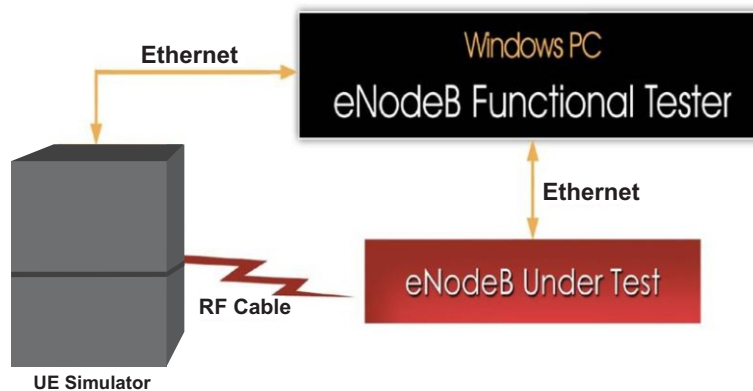


Figure : eNodeB Functional Tester - Test Bed Setup

### The test bed consists of:

- ☐ PC running the eNodeB Functional Tester. FT emulates one or more MME, S-GW and eNodeB
- ☐ eNodeB - Device Under Test
- ☐ UE Simulator

Performing automated Functional Tests in-house is essential for vendors who wish to minimize time-to-market. One of the key emphases of the eNodeB Functional Tester is Test Automation, achieved from the following components of the tester.

### Test Executive

The Test Executive is a Windows application and serves as the test manager for the eNodeB Functional Tester. It has a user-friendly GUI that allows the user to select and execute test cases, view test results, save test results, generate test reports and load previously saved results.

- ➔ Test Bed Setup and Configuration
- ➔ Test Selection and Execution
- ➔ Analysis of Test Results
- ➔ Protocol Decodes
- ➔ Generation of Test Reports
- ➔ Editing Tcl Test Scripts

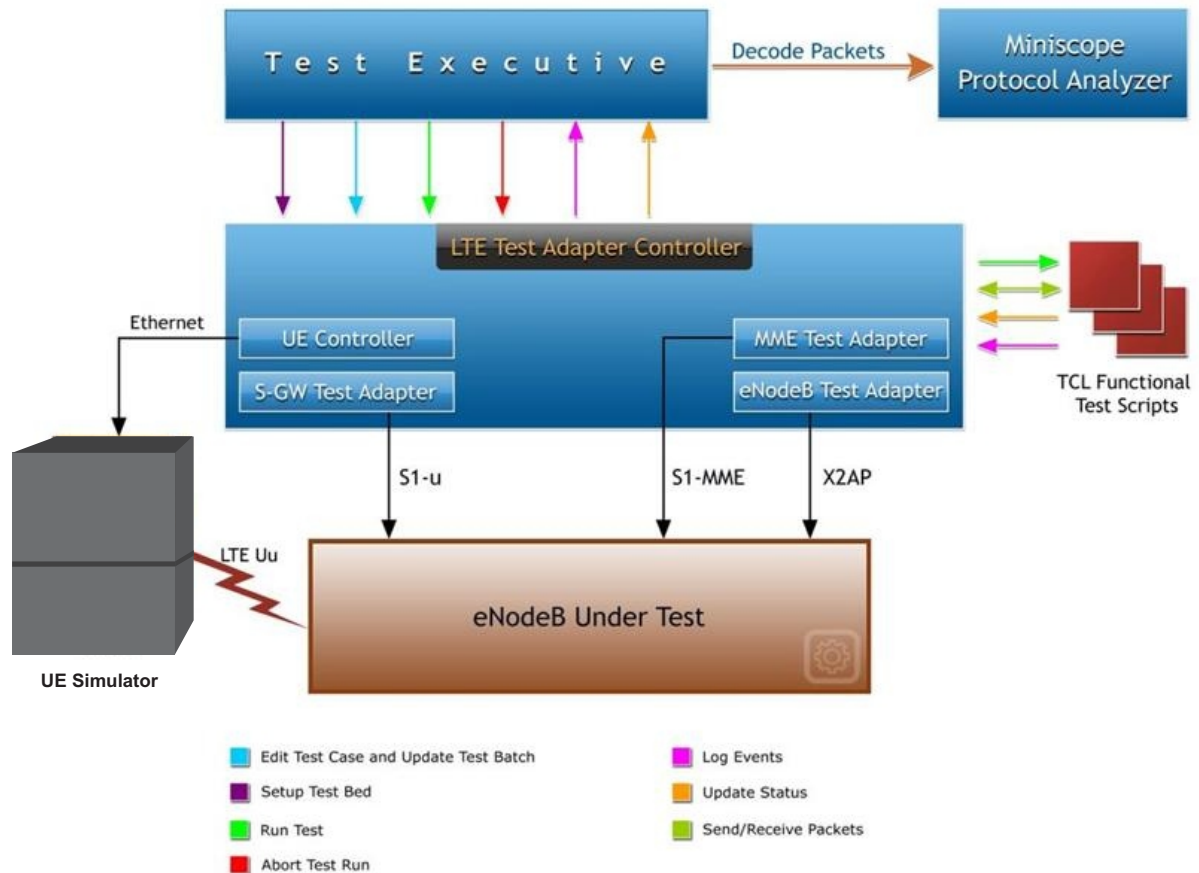


Figure : eNodeB Functional Tester Architecture

## Miniscope Protocol Analyzer

Miniscope is a protocol decoder integrated with Test Executive. Protocol messages that are exchanged during a test case execution are logged in Miniscope real-time. Users can click on any message in Test Executive and view the decode of that message in Miniscope. As the Test Executive allows users to save the current Test Results and to load previously saved results, users can view the protocol decode of the messages offline also.

## Tcl Functional Test Scripts

Test cases are implemented using Tcl language. Polaris delivers the test cases in source code form to allow the users to view, edit, modify or enhance the test cases.

## FEATURES

- PNFT-ENB-810 features over 200 functional tests
- Tester emulates all adjacent entities, i.e. eNodeB, SGW and MME
- Provides complete and detailed decode of all protocol layers
- Test Scripts are written in Tcl language
- Tcl test scripts are provided in source code form
- Users can change existing tests and write their own tests
- User friendly GUI for test selection and execution
- Includes 'Command Line Interface' for integration with automated test frameworks
- Users can schedule test runs for execution in the future and run tests in batches
- Test reports generated in HTML format
- Multi-pane display: Message logging, message decoding, message sequence diagrams. If a message is clicked on in any one pane, corresponding messages are highlighted in other two panes

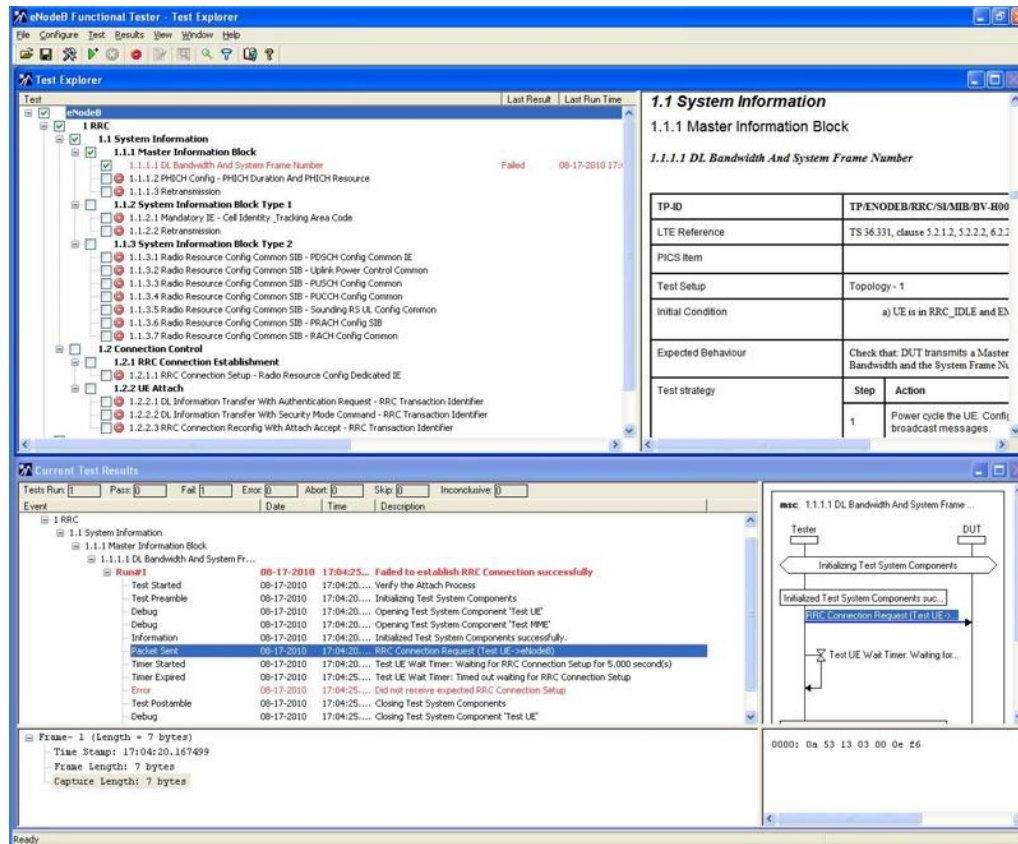


Figure : eNodeB Functional Tester GUI

## TEST CATEGORIES

### LTE Uu (L2/3) Test Cases

- ➔ **PDCCP Test Cases**
  - Header compression, Ciphering, Integrity protection, Timer-based discard of PDUs, etc.
- ➔ **RRC Test Cases**
  - Establishment, modification and release of RRC connection, Paging, RRC connection mobility, Measurement configuration control and reporting, etc.
- ➔ **RLC Test Cases**
  - Data Transfer Procedures
- ➔ **MAC Test Cases**
  - Data Transfer Procedures

### S1-MME Test Cases

- ➔ SAE Bearer management
- ➔ Initial context transfer
- ➔ UE Capability Info indication
- ➔ Handover with MME relocation
- ➔ Mobility and Handover
- ➔ Paging
- ➔ S1 Interface management
- ➔ NAS Signaling transport

### X2 Test Cases

- ➔ Intra LTE-Access-System Mobility and Handover
- ➔ Uplink Load Management
- ➔ General X2 Interface Management and Error Handling

## TECHNICAL SPECIFICATIONS

### System Requirements

- ➔ eNodeB Functional Tester runs on a PC with x86 or x86-64 CPU, minimum 2 GB RAM and supports all professional & business versions of Windows OS
- ➔ UE Simulator

### System Interfaces

- ➔ 10/100/1000 Ethernet for connecting eNodeB DUT to the eNodeB Functional Tester
- ➔ CPRI 4.0 and RF interfaces

### Supported Specifications

- ➔ 3GPP TS 36.211 Evolved Universal Terrestrial Radio Access (E-UTRA) Physical Channels and Modulation
- ➔ 3GPP TS 36.212 Evolved Universal Terrestrial Radio Access (E-UTRA) Multiplexing and channel coding
- ➔ 3GPP TS 36.213 Evolved Universal Terrestrial Radio Access (E-UTRA) Physical layer procedures
- ➔ 3GPP TS 36.321: E-UTRA Medium Access Control (MAC)
- ➔ 3GPP TS 36.322: E-UTRA Radio Link Control (RLC)
- ➔ 3GPP TS 36.323: E-UTRA Packet Data Convergence Protocol (PDCP)
- ➔ 3GPP TS 36.331: E-UTRA Radio Resource Control (RRC)
- ➔ 3GPP TS 36.413: E-UTRA S1 Application Protocol (S1 AP)
- ➔ 3GPP TS 36.423: E-UTRA X2 Application Protocol (X2 AP)
- ➔ 3GPP TS 29.281 General Packet Radio System (GPRS) Tunneling Protocol User Plane (GTPv1-U)
- ➔ IETF RFC 4960 Stream Control Transmission Protocol

## CONTACT INFORMATION

For further information, please contact Polaris Networks either by emailing us at [sales@polarisnetworks.net](mailto:sales@polarisnetworks.net) or by calling the phone numbers listed here :

### USA

Phone: +1-408-625-7273

### INDIA

Phone: +91-33-23575511  
VoIP: +1-781-652-9603

### INDIA OFFICE

EP Y3, Sector V,  
Salt Lake Electronics Complex  
Kolkata 700091  
India

### US OFFICE

Polaris Networks  
14856 Holden Way,  
San Jose, CA 95124  
USA