MAPS™ LTE X2 Interface Emulator

LTE X2 Application Protocol Interface Emulation
MAPS™ LTE X2-AP Architecture

MAPS™ X2AP in LTE network
Main Features

• Setup a virtual real-time network simulating 4G-LTE network elements using ‘MAPS™ 4G Wireless Lab Suite’

• Simulate two eNodeB elements in LTE X2-AP interface.

• Supports LTE Control plane.

• Generates hundreds of UE Signalling (Load Testing).

• Generates and process X2-AP (valid and invalid) messages.

• Supports Mobility Management, Load Management, Reporting of General Error Situations, Re-setting X2, Setting up the X2, and eNodeB Configuration Update procedures.

• Insertion of impairments to create invalid messages.

• Supports LTE Conformance designed with 50+ test cases as per 3GPP TS 36.243 Specification
Applications

• Complete analysis and simulation capability on par with any protocol tester in the market.
• Provides fault insertion, and erroneous call flows testing capability.
• Functional testing, Regression testing and Conformance testing of network elements.
• Ready scripts make testing procedure simpler, less time consuming and hence time to market products.
• Simulate Thousands of Smartphones (UEs) powering up and down.
• Authenticate and confirm security procedures.
• QoS requests for greater or lesser bandwidth.
• Temporary addressing management for mobility and security.
Functions

- **Mobility Management** - This enables the serving eNodeB to move the specified UE responsibility to a target eNodeB.

- **Load Management** - procedure to report resource status, overload indications and current traffic loading between the eNodeBs

- **Reporting of General Error Situations** - procedure to report general error situations

- **Re-setting /Setting the X2** – procedure to setup or reset X2 interface by exchanging the necessary information between the eNodeBs

- **eNodeB Configuration Update** - procedure to update the application level data required for the eNodeBs to interoperate in the network.
Protocol Standards

<table>
<thead>
<tr>
<th>Supported Protocols</th>
<th>Standard / Specification Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>X2 Application Protocol (X2-AP)</td>
<td>3GPP TS 36423-900</td>
</tr>
<tr>
<td>SCTP</td>
<td>RFC 4960</td>
</tr>
<tr>
<td>Non-Access-Stratum (NAS)</td>
<td>3GPP TS 24.301 V9.0.0 (2009-09)</td>
</tr>
</tbody>
</table>
LTE X2AP Call Scenario

MAPS™ LTE X2AP Configured as Source eNB

Source eNodeB

(eNodeB)

MAPS™ LTE X2AP

DUT

Rx

Tx

MAPS™ LTE X2AP Configured as Target eNB

Target eNodeB

(eNodeB)

DUT

Rx

Tx

Target eNodeB

(eNodeB)

MAPS™ LTE X2AP

Source eNodeB

(eNodeB)

(eNodeB)
X2AP Interface Procedures

Mobility Management
- Handover Preparation
- SN Status Transfer
- UE Context Release
- Handover Cancel

Load Management
- Load Indication
- Resource Status Reporting Initiation
- Resource Status Reporting
X2AP Interface Procedures

Reseting the X2

X2 Setup Request

X2 Setup Response

Setting up the X2

Reset Request

Reset Response

eNB Configuration Update

eNB Configuration Update

eNB Configuration Update Acknowledge
Call Generation

Call Generation (Source eNodeB)
Call Generation and Reception

Call Reception (Target eNodeB)
MAPS Feature

Call Statistics and Event Log

Call Statistics

Event Log
Load Generation

- Stability/Stress and Performance testing using Load Generation
- Different types of Load patterns to distribute load
- User can load multiple patterns for selected script
- User configurable Test Duration, CPS, Maximum and Minimum Call Rate etc

Fixed

Ramp

Uniform

Normal

Saw-tooth

Step
Testbed Configuration
Incoming Call Handler Configuration

**Message Name** | **Script Name**
--- | ---
ResourceStatusRequest | GlobalProceduresHandler.gls
HandoverRequest | X2APSessionController.gls
X2SetupRequest | GlobalProceduresHandler.gls
ResetRequest | GlobalProceduresHandler.gls
ENBConfigurationUpdate | GlobalProceduresHandler.gls
LoadInformation | GlobalProceduresHandler.gls

Scripts

- X2APSessionController.gls

**Options**
- Sequence
- Random

**Buttons**
- Add
- Delete
- Clear Scripts
- Add
- Delete
Customizations - Call Flow (Scripts)
Customizations - Protocol Messages
Customizations - Statistics and Reports

MOS, R-Factor
Packet Loss
Packets Discarded
Duplicate Packets
Out-Of-Sequence Packets
Jitter Statistics

Call Stats provide a running tabular log of system level stats, tracked stats include: Total Calls, Active Calls, Completed Calls, Passed Calls, Failed Calls, Instantaneous Calls/Sec
MAPS™ LTE X2 emulator can be configured as **Source eNodeB** connected to DUT (Target eNodeB). The conformance script can simulate various procedures conforming success/failure test cases and automating the entire Target eNodeB (DUT) testing.

Following are the supported test cases -

- **Handover Test Case**
  - Handover success
  - Handover failure (invalid GTP-TEID, duplicated E-RAB ID)
- **Load Indication** (send load to and receive load from target eNodeB)
- **Error Indication** (send error to and receive error from target eNodeB)
- **X2 Setup**
  - X2 Setup Success
  - Setup failure and resend setup
- **Configuration update**
  - Send/receive configuration update
  - Configure update success after re-send
  - Resend Configuration update after failure
  - Response Configuration update failure
LTE-X2 Conformance Suite
THANK YOU