**Overview**

GL’s MAPS™ LTE-S1 Interface Emulator is an advanced protocol simulator/tester for LTE simulation over S1 Interface that can simulate S1-AP/NAS messages and signaling specification as defined by 3GPP standards. GL’s MAPS™ LTE - S1 network can simulate and test eNodeB (Evolved Node B), and MME (Mobility Management Entity). eNodeB is the base station in the LTE/SAE S1 interface and also includes MME (to handle signaling of control plane) as shown in the network diagram.

GL’s PacketLoad appliance supports massive simulation of UEs (up to 500000) with high density (up to 4 Gbps or 40 Gbps) mobile data traffic simulation over LTE network. The solution offers stateful TCP/HTTP, and PCAP Replay traffic types.

In addition, GL’s High Density RTP appliance is an advanced bulk call generator used to simulate high volume calls (hundreds of calls/sec) with traffic and high volume of sustained calls (tens of thousands of simultaneous calls/platform) over LTE network. The tester also supports error tracking, regression testing, conformance testing, load testing/call generation. Test cases include general messaging and call flow scenarios for enhanced mobile radio and internet access.

For more information on MAPS™ LTE S1, refer to [http://www.gl.com/maps-lte-s1.html](http://www.gl.com/maps-lte-s1.html).

**Main Features**

- Supports complete end-to-end simulation of real-time VoLTE network using “MAPS 4G Wireless Lab Suite”.
- Multiple eNodeB supports thousands of UEs
- Simulates eNodeB, and MME entities in S1 interface; Generates and process S1/NAS valid and invalid messages
- Generate thousands of VoLTE UE Signaling (Load testing)
- Supports LTE Control and GTP User Plane Data
- Traffic profiling capability: A real web browsing is supported along with generation of real-world traffic in the lab.
- Insertion of impairments to create invalid messages
- High Density GTP traffic simulation using PacketLoad and Voice traffic simulation using RTP HD appliance
- Handover (S1, X2) support including Intra/Inter MME, IRAT HO
- UE initiated signalling for CSFB
- Support for SNOW-3G, AES, 128-EEA2 and 128-EEA0
- Supports multiple Default/Dedicated bearer Creation/Modification/Deletion per UE
**Testbed Configuration**

The testbed setup window allows users to setup the required test environment with SCTP configuration in S1 interface.

**SCTP Configuration** parameters consists of source / destination IP address, port, including stream id, payload id to configure MAPS™ to simulate eNodeB and MME entities in S1 interface. MAPS™ can then generate and receive S1AP/NAS messages to/from valid IP Address in the LTE network.

End user configuration profile used to configure MAPS™ LTE S1 with supported eNodeBs and MME parameters.

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**Pre-processing Tools**

**MESSAGE EDITOR** - With message editor, users can build a template for each protocol message type. The value for each field may be changed in the message template prior to testing. The protocol fields comprises of mandatory fixed parameters, mandatory variable parameters, & optional variable parameters.

**SCRIPT EDITOR** - The script editor allows the user to create / edit scripts and access protocol fields as variables for the message template parameters. The script uses pre-defined message templates to perform send and receive actions.

**PROFILE EDITOR** - This feature allows loading profile to edit the values of the variables using GUI, replacing the original value of the variables in the message template. An XML file defines a set of multiple profiles with varying parameter values that allow users to configure call instances in call generation and to receive calls.

The UE_Profiles includes VoLTE parameter required to configure multiple UEs to simulate Voice over LTE calls.

Supports Mobile Traffic parameter settings allowing simulation of offline HTTP Traffic using Mobile IP Core TCP Client Server connections. Configurations include TCP Server IP, TCP Port for HTTP and HTTP files names.

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![Figure: Testbed Setup](image1.png)

![Figure: Message Editor](image2.png)

![Figure: Script Editor](image3.png)

![Figure: Profile Editor](image4.png)
Call Generation and Call Reception
In call generation, MAPSTM is configured for the outgoing messages, while in call receive mode, it is configured to respond to incoming messages. Tests can be configured to run once, multiple iterations and continuously. Also, allows users to create multiple entries using quick configuration feature.

The editor allows to run the added scripts sequentially (order in which the scripts are added in the window) or randomly (any script from the list of added script as per the call flow requirements).

The test scripts are started manually at call generation; and at the call reception, the script is automatically triggered by incoming messages.

Simulation of LTE S1 Signaling Procedure
Given below is a general LTE-S1 signaling scenario, the messages between eNodeB (eNB) and MME (Mobility Management Entity) are simulated using MAPSTM application.

Incoming Call Handler
The Incoming Call Handler contains a list of message types, each with a corresponding script. At the receiving end the expected initial message is compared with this list of messages, and if a match is found, the corresponding script is executed. Loaded answer scripts against the messages expected from the DUT:
- PDN Connectivity Request message: S1SessionControl.gls script
- Tracking Area Update Request message: S1SessionControl.gls script
- S1SetupRequest message: S1APManagementHandler.gls script used to respond to management procedures by sending S1 Setup Response Message

Capture Event Log
MAPSTM provides Events, Error Events, and Captured Errors log encountered during the progress of the call. The events are saved in the database which can be accessed via web interface.

Protocol specific signaling events and the traffic events are logged along with the Call Trace ID, Script Name, Script ID, and the Timestamp of the occurred event.
**End-to-End VoLTE Call Simulation**

The VoLTE Lab setup can be operated in real-time for making VoLTE calls and also for interworking with PSTN and VoIP networks as depicted in the diagram below. The VoLTE Lab Test Suite supports emulation of several LTE interfaces (S1, X2-AP, S3, S4, S5, S8, S10, S11 and S16), and IMS interfaces (Cx/Dx, Rx, Gx, Gm, SGi, Mw, Mi, Mj).

The test suite supports generation and verification of traffic over LTE, including VoLTE (Voice), Web (HTTP), and more with additional licenses. It can be integrated with High Density RTP appliance to simulate high volume calls with traffic. MAPS™ HD RTP (PKS109) is a special purpose rackmount network appliance with 4x1GigE NIC capable of bulk call generation with traffic.

Following are typical applications of VoLTE Lab Setup -

- Authenticate and confirmation of security procedures
- QoS requests for greater or lesser bandwidth
- Temporary addressing management for mobility and security

For more information, please visit VoLTE Lab Test Suite webpage.

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**Figure: VoLTE Simulation using GL’s Complete Wireless Lab Test Suite**

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**Supported Protocols and Specifications**

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<th>Standard / Specification</th>
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<td>3GPP 36.413 9.0.0 (2009-09)</td>
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<tr>
<td>SCTP</td>
<td>RFC 4960</td>
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<tr>
<td>Non-Access-Stratum (NAS)</td>
<td>3GPP TS 24.301 V9.0.0 (2009-09)</td>
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**Buyer’s Guide**

- PKS140 - MAPS™ - LTE S1 Interface
- ETH100 - Mobile Traffic - PacketCheck™
- ETH101 - MobileTrafficCore - GTP
- ETH102 - MobileTrafficCore - Gateway

**Related Software**

- PKS127 - MAPS™ IMS Emulator
- PKS139 - MAPS™ Diameter Emulator
- PKS142 - MAPS™ LTE eGTP (S3, S4, S5, S8, S10, S11 and S16) interfaces
- PKS164 - MAPS™ UMTS Iu-PS Interface Emulation
- PKS160 - MAPS™ UMTS Iu-CS and Iuh Interface Emulation
- PKV100 - PacketScan™ (Online and Offline)

For complete list of MAPS™ products, refer to [http://www.gl.com/maps.html](http://www.gl.com/maps.html) webpage.