# MAPS<sup>™</sup> LTE S1 - Long Term Evolution (LTE) S1 Emulator and Conformance



#### **Overview**

GL's **Message Automation and Protocol Simulation (MAPS)™ LTE-S1** is an advanced protocol emulator for LTE emulation over S1 interface that can emulate S1-AP/Non-Access Stratum (NAS) messages and signaling as per 3GPP standards.

MAPS<sup>™</sup> LTE - S1 can emulate 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 above network architecture.

GL's also offers MAPS<sup>™</sup> LTE conformance test suite (PKS154) designed with 50+ test cases, as per 3GPP TS 36.413 specification. It includes inbuilt conformance scripts (\*.gls) for eNodeB and MME nodes in S1 interface. Test cases include general Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP) messaging and call flow scenarios over LTE network. Logging and pass/fail results are also reported. Test cases verify conformance of actions such as UE attach/detach, periodic updating, Handover procedure, UE context release, and error indication

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

User-plane packet traffic emulation in LTE network requires additional mobile traffic core - GTP (ETH101) and mobile traffic core – Gateway (ETH102) applications.

The application also supports error tracking, regression testing, conformance testing, load testing. Test cases include general messaging and call flow scenarios for enhanced mobile radio and internet access.

For more information, visit <u>MAPS<sup>™</sup> LTE S1</u> webpage.

# 🌑 GL Communications Inc.

818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878, U.S.A (Web) <u>www.gl.com</u> - (V) +1-301-670-4784 (F) +1-301-670-9187 - (E-Mail) <u>info@gl.com</u>

#### **Main Features**

- Supports complete end-to-end emulation of real-time VoLTE network using "MAPS 4G Wireless Lab Suite"
- Multiple eNodeB supports thousands of UEs
- Emulates 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
- Massive UE emulation with Auto generation feature for high density load testing
- Supports large number of subscribers with CSV based profiles for bulk call generation
- Insertion of impairments to create invalid messages
- High Density GTP traffic emulation using <u>PacketLoad</u><sup>™</sup> and Voice traffic emulation using <u>RTP HD appliance</u>
- Handover S1 support including Intra/Inter MME, IRAT HO
- UE initiated signaling for CSFB and Supports PacketLoad™ PCAP playback feature
- Support for SNOW-3G, AES, 128-EEA2 and 128-EEA0
- Supports LTE S1 interface conformance test suite with 50+ test cases as per 3GPP TS 36.413 specification

## **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<sup>™</sup> to emulate eNodeB and MME entities in S1 interface. MAPS<sup>™</sup> can then generate and receive S1AP/NAS messages to/from valid IP Address in the LTE network.

Auto Generated Users Info configuration required to emulate multiple calls. End user configuration profile used to configure MAPS<sup>™</sup> LTE S1 with supported eNodeBs and MME parameters.

MAPS MME (LTE S1 RELEASE15 ) - [Testbed Setup - Test	BedDefault]		-	$\Box$ ×
Configurations Emulator Reports Editor Debu	g Tools Windows Help			- 8 ×
🚱 🗐 🎼 🍬 🗞 🖡 🛢 📕 🥑 🧉	2	: 🔒 🕐	0	
				0
	Velue	A LT Fachle		
	value			
	1			
	1			
L MME ID Address	102 168 13 127			
	152.100.15.121			
H Mobile Country Code	001			
Mobile Network Code	01			
- MME Group Id	032B			
- MME Code	52			
- MME Name	MME01			
- Tracking Area Identity List				
- Type of List	Consecutive TAC values			
- TAC List	0001			
Number of Consecutive TAC Values	2			
SupportedeNBs				
L eNodeBs	1			
L eNodeBs 1				
<ul> <li>eNodeB IP Address</li> </ul>	192.168.13.121			
<ul> <li>eNodeB Port</li> </ul>	36412			
<ul> <li>MME Port</li> </ul>	36412			
– eNodeB ld	197094			
<ul> <li>eNodeB Name</li> </ul>	eNB02			
<ul> <li>Source SCTP Mode</li> </ul>	Server			
L TAC	0002			
- APN Configuration	3			
APN Configuration 1				
<ul> <li>APN Name</li> </ul>	default			
- IPv4 Range				
- Start IP	192.168.121.1			
L End IP	192.168.140.250			
He IPv6 Range				
HEI APN Configuration 2	internet.			
- APN Name	internet			
High IPV4 Kange	102 169 141 1			
F Start IP	192.108.141.1			
I IPv6 Range	192-100-100-200	✓ Start	Edit	t
		Initi	alisation	Errors

**Figure: Testbed Configuration** 



#### **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, and optional variable parameters.



Figure: Message Editor

#### **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.

🔮 ScriptEditor - [C:\Program Files\GL Cor	mmunications Inc\MAPS-LTES1\MAPS\LTE S1\RELEASE15\eNodeB\Scripts\S1SessionControl.gls] – 🛛	×
쑿 File View Edit Shortcuts Tools	Help _	e ×
🗅 📽 🖬 🗙 🕷 📑	§ 0,	
Command Window	S1SessionControl	He
Action	//************************************	_ Þ
庄 Conditional & Flow Control 2		l ŝ
🗄 Variable 3	if(_SICONNECTION=="Successful")	- P
Maps CLI     4	goto "CONTINUE";	-
Erect Logs / Comment 5	else	
⊞ Init 6	ErrorLog("S1-SETUP FAILED");	
	exit;	
DataBase     8	endif	
Send Report 9		
Resume 10	"CONTINUE"	
Return 11	ReportEvent (Script = "Running");	
Include 12	<pre>//ReportEvent(IsTransportUp = "Down");</pre>	
EXIT 13	LTESIScriptid = "Null";	
H-Ouity Functions 14	mipaginginitiated="faise";	
15	AuthenticationLogs=0; //To display Authentication Parameters	
10	CTR second second starting (The disclose CTR second Research Second Seco	
1/	Techlagenerging and the technical state of technical stat	
10	Trease 0.	
19	BrCount-0;	
20	n Pilocount-0.	
21	File Two-unt=0.	
22	File_ExCount 0.	
24	MMECodeInt=S MMECode·	
25	MMFGrnIDInt=S_MMFGrnID·	
26	MMECodeHex=S MMECodeHex·	
27	MMEGroIDHex=S MMEGroIDHex:	
28	Index = 1:	
29	TempIndex = 0; //For Sip Reg scripts	
30	TempIndex2 = 0; //For Sip Voice scripts	
31	IsSipRegistered="False";	
32	CallHoldInitiated=0;	i
<	>	
Ready	Line Count - 2014   Line : 1 Col : 1	/

**Figure: Script Editor** 

## 🚳 GL Communications Inc.

### Pre-processing Tools (Contd.)

#### **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 emulate Voice over LTE calls.

Supports Mobile Traffic parameter settings allowing emulation 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.



**Figure: Profile Editor** 

### 🌑 GL Communications Inc.

#### **Call Generation and Call Reception**

In call generation, MAPS<sup>™</sup> is configured for the out going 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.

in a contract (and other party [can contract on contract party ]					-		
Configurations Emulator Reports Editor Debug Tools Windows Help						-	-
<u>                                       </u>	6						
No Script Name Profile Call Info Script Execution S	tatus	Events	Events Profile	Result	Total Iterations	Comple	eted
1 S1SessionControl.gls UEProfile0001 MSI:,00101301204 Start	UE-Deregistered	None		Pass	1		1
2 S1SessionControl.gls UEProfile0002 Start		None		Unknown	1		0
3 S1SessionControl.als UEProfile0003 Start		None		Unknown	1		0
Add Delete Insert Refresh Start Start All Stop 🔽 Stop All 🔽 Abort Abor	: All						_
Save Column Width Show Latest							
			Find				
eNodeB U MME			SlAP Laver				_
InitialUEMessage, Attach Request, PDN Connectivity Request, 12:33:5	1.171000	SIAP-PDU	,		= CH0	ICE	
DownlinkNASTransport Authentication Bequest		Extensibili	ty Marker		= 0		
12:33:5	1.423000	Initiating	x Message		= U = SEC	UENCE	
UplinkNASTransport, Authentication Response,	1 404000	Procedure	Code		= INT	EGER	
12:33:3	1.424000	Contents			= 12	id-initi	ía
DownlinkNASTransport, Security Mode Command, 12:33:5	1 445000	Criticali	ty		= ENU = 1	MERATOR ignore()	11
Lielini-NACT revenuet - Security Made Complete		Value			= 0pe	n Type	.,
12:33:5	1.446000	Length			= 146		
DownlinkNASTransport, ESM Information Request,		InitialUE	Message		= SEQ	UENCE	
12:33:5	1.467000	Protocol	.IICY narker .IE-Container		= 0 = SEC	UENCE OF	e
UplinkNASTransport, ESM Information Response, 📃 12.03.6	1 469000	Iteratio	n Count		= 6		
12.33.3	1.400000	Protocol	IE-Container		= Ins	tance 0	
InitialContextSetupRequest, Attach Accept, Activate Default EPS Bearer Context Request, 12:33:5	1.495000	Protoco	lIK-Field		= SEQ = INT	UENCE	
InitialContextSeturBesponse		Conten	ts		= 8 i	d-eNB-UE	g –
12:33:5	1.497000	Critic	ality		= ENU	MERATOR	
UplinkNASTransport, Attach Complete, Activate Default EPS Bearer Context Accept,	1 407000	Conten	ts		= 0	reject(O	))
12:33:5	1.497000	Length			= 0pe = 3	n lype	
UplinkNASTransport, PDN Connectivity Request, 12:33:5	1 498000	eNB-UE	-SIAP-ID		= INT	EGER	
E DADCature Damarati, A ativate Datavity EDC Damara Cardant Barrant		Length	Determinant		= 2	~ .	
2-hAbSetuphequest, Activate Detaut Ers beater Context hequest, 12:33:5	1.522000	Lonten Protocol	cs IE-Container		= 100 = Ins	ui tance l	
E-RABSetupResponse,		Protoco	lIE-Field		= SEQ	UENCE	
12:33:5	1.524000	Protoc	OIIE-ID		= INT	EGER	
UplinkNASTransport, Activate Default EPS Bearer Context Accept, 12:33:5	1 524000	Conten	ts alitv		= 26 = ENU	1d-NAS-P. MERATOR	ЯD
United Mild CT and an A DDM Discourse the Provent		Conten	ts.		= 0	reject(0	c)
12:34:5	1.531000	value			= 0pe	n Type	
E-RABReleaseCommand, Deactivate EPS Bearer Context Request.		Length NAS-DD	ЛТ		= 94	RT STRIM	រាច
12:34:5	1.548000	NAS-PD	Ű		= x07	41710809	эı
E-RABReleaseResponse, 12-34-5	1 549000	Protocol	IE-Container		= Ins	tance 2	
	1.343000	Protoco	lIE-Field		= SEQ - INT	UENCE	
UplinkNAS Fransport, Deactivate EPS Bearer Context Accept, 12:34:5	1.550000	Conten	ts		= 67	id-TAI	
UplinkNASTransport, Detach request.		Critic	ality		= ENU	MERATOR	_
12:34:5	1.550000	Conten	ts		= 0	reject(O	))
DownlinkNASTransport, Detach Accept, 12:04-5	1 570000	Length			- Upe = 6	n type	
12:34:5	1.570000	TAI			= SEQ	UENCE	
UEContextReleaseCommand, 12:34:5	1.570000	Extens	ibility Mark	er	= 0		
	U —		_				
Scripts Message Sequence Event Config Script Flow							

**Figure: Call Generation** 



#### Call Generation and Reception (*Contd.*)

MADS MARE // TE S1 DELEO SE15) [Call Descention]					
MAPS MIME (ETE ST RELEASETS) - [Call Reception]				-	
Configurations Emulator Reports Editor Debug lools Windows Help					- 6 ×
i 🐼 🗐 🎭 🔌 🖡 🃁 🎝 🝼 🔮 🔓 🔓 😤 😓 (	0 😳				
Ce Ma Carint Mana Brafila Call Infa	Cariet Eugenstion	Status	Evente	Events Profile Deside	
1 S1ADM segmential and an	Script Execution	Status S1.LINK.LIP	Lodate MME Configuration	E VERKS FTUILIE   HESUKS	Page
2 S1SessionControl ds UEProfile0001 IMSL001013012041631	Comple	ed LIE-CONTEXT-BELEASED	None		Pass
	0011010			ļ.	
Stop Stop All Abort Abort All Show Records Select Active Call Auto Tra	shTrash Show	Hidden Calls			
Cours Column Midth Show Latert					
eNodeB	MME	Find			
InitiaUEMessage, Attach Request, PDN Connectivity Request,	10.00.51 (10000	Slap-DDN		CHOICE	
	12:33:51.412000	Extensibility Marker		0	
DownlinkNASTransport, Authentication Request,	12:33:51.414000	Choice Index	-	0	
LininkNASTransport, Authentication Besponse		ProcedureCode		INTEGER	
operate to realizery, reasonation recepting,	12:33:51.433000	Contents	-	12 id-initialUEMessa	ge
DownlinkNASTransport, Security Mode Command,	12-22-51 424000	Criticality	-	ENUMERATOR	
	12:33:01.434000	Contents Value		l ignore(l) Onen Tume	
UplinkNASTransport, Security Mode Complete,	12:33:51.457000	Length	=	146	
DownlinkNASTransport FSM Information Bequest		InitialUEMessage		SEQUENCE	
	12:33:51.457000	Extensibility Marker ProtocolIE-Conteiner		SEGUENCE OF	
UplinkNASTransport, ESM Information Response,	10-00-61 470000	Iteration Count	-	6	
	12.33.31.476000	ProtocolIE-Container	-	Instance 0	
InitialContextSetupHequest, Attach Accept, Activate Default EPS Bearer Context Hequest,	12:33:51.481000	ProtocollE-Field ProtocollE-ID		INTEGER	
InitialContextSetupBesponse.		Contents		8 id-eNB-UE-S1AP-ID	
	12:33:51.508000	Criticality	-	ENUMERATOR	
UplinkNASTransport, Attach Complete, Activate Default EPS Bearer Context Accept,	12:33:51 509000	value		0 reject(0) Open Type	
U. L. U. K. CT	12.00.01.000000	Length	-	3	
Opinikinkas Hanspolt, PDN Connectivity Request,	12:33:51.509000	eNB-UE-S1AP-ID		INTEGER 2	
<ul> <li>E-RABSetupRequest, Activate Default EPS Bearer Context Request,</li> </ul>		Contents		10001	
	12:33:51.511000	ProtocolIE-Container	=	Instance 1	
E-RABSetupResponse,	12:33:51.533000	ProtocolIE-Field ProtocolIE-ID		SEQUENCE	
Unlink/NASTransnort Activate Default EPS Rearer Context Accent		Contents	-	26 id-NAS-PDU	
opiniki wa Hangoli, Marvale Delak Er a Beard Contex Accept,	12:33:51.534000	Criticality	-	ENUMERATOR	
UplinkNASTransport, PDN Disconnect Request,	12-24-51 520000	Uontents value		u reject(U) Open Type	
	12.04.01.000000	Length	=	94	
E-HABHeleaseLommand, Deactivate EPS Bearer Lontext Request,	12:34:51.540000	NAS-PDU NAS-DDU		OCTET STRING	06112048050
E-RABReleaseResponse,		ProtocolIE-Container	-	Instance 2	001130480600
	12:34:51.557000	ProtocolIE-Field	-	SEQUENCE	
UplinkNASTransport, Deactivate EPS Bearer Context Accept,	12:34:51 558000	ProtocolIE-ID Contents		INTEGER 67 id-TAT	
UnlinkNASTransport, Datach request		Criticality	-	ENUMERATOR	
Uplinkinko Hansport, Detach request,	12:34:51.558000	Contents		0 reject(0)	
DownlinkNASTransport, Detach Accept,	10.04.51.550000	Value	-	Open Type 6	
	12:34:51.553000	TAI	-	SEQUENCE	
UEContextReleaseCommand,	12:34:51.559000	Extensibility Marker	-	0	
LIE ContextBeleaseComplete		Preamble PLMNidentity	-	OCTET STRING	
	12:34:51.580000	0076 HCC	-	001	
				~	
Scripto Massage Seguence Event Config Script Flow					
8	Initialisation Errors	Error Events	Captured Errors	Link Status Up=1 Do	wn=0

**Figure: Call Reception** 

## **Capture Event Log**

MAPS<sup>™</sup> 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.

Configurations Err	nulator Reports Editor Debug Tools Windows He	elp		- 5
Q 🖉 🚳 🧆	🌯 🗳 🍎 🌆 🧭 🐲	-2 - 2 0 0		
vent Log Error Events	Captured Errors			
ate/Time	Captured Events	Call Trace Id	Script Name	Script Id
22-5-6 12:30:15.237000	SCTP Up On ConnectionId = 1002		Check SCTP Status.gls	ProtScriptId-0-6609156-1295.
22-5-6 12:30:15.281000	Setup Completed	MMEName: ,MME01,MMEGr.	S1APManagementHandler.gl	s ProtScriptId-1-6611910-1296.
22-5-6 12:30:15.891000	Listen IP Address = 192.168.13.127, Port = 20000		MapsInit.gls	
22-5-6 12:33:51.414000	RAND=0x98922DF350DB451DC1FFB860602A585A	2	S1_MME.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:33:51.414000	Authentication Parameters	2	S1_MME.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:33:51.414000	RES = 0x009A191706F56C55	2	S1_MME.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:33:51.433000	Received RES=0x009A191706F56C55, RESLength=8	2	S1_MME.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:33:51.433000	kasume =0x9B0F4F2E812B8CA2ADB69DFCA06A8A8764A	. 2	S1_MME.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:33:51.434000	Security Mode Command Sent	IMSI,001013012041631	S1SessionControl.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:33:51.457000	<ul> <li>OnSecurityModeComplete - APNName : default, SGWTraffic</li> </ul>	IMSI,001013012041631	S1SessionControl.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:33:51.476000	Allocated APNName : internet_5000,PDNIPAddress : 192.1	IMSI,001013012041631	S1SessionControl.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:33:51.482000	Send:Initial Context Setup Request	2	S1_MME.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:33:51.510000	Allocated APNName : ims_5000,PDNIPAddress : 192.168.1	IMSI,001013012041631	S1SessionControl.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:33:51.533000	recv:E-RABSetupResponse	2	S1_MME.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:34:51.539000	****PDN Disconnect Request**** - APNName = ims, PDNIP	2	S1_MME.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:34:51.557000	recv:E-RABReleaseResponse	2	S1_MME.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:34:51.559000	***DetachAccept*** - APNName = internet, PDNIPAddress	IMSI,001013012041631	S1SessionControl.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:34:51.559000	Send:UEContextReleaseCommand	2	S1_MME.gls	ProtScriptId-1-6827944-1296.
22-5-6 12:34:51.580000	Recv:UEContextReleaseComplete	2	S1_MME.gls	ProtScriptId-1-6827944-1296.
<u>Save Ev</u>	rents			
Clear Can	ture Events to file			

**Figure: Events Log** 

## **GL** Communications Inc.

#### **Emulation of LTE S1 Signaling Procedure**

Given below is a general LTE-S1 signaling scenario, the messages between eNB and MME are emulated using MAPS™ application.



Figure: LTE S1 Signaling Procedure

#### **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

MAPS MME (LTE S1 RELEASE15 ) - [Ir	ncoming Call Handlers Configuration - defaul	t]	– 🗆 ×
E Configurations Emulator Report	s Editor Debug Tools Windows Help		_ <i>8</i> ×
🎯 🖉 🎼 🕈 🦠 🖡 🖠	) 📰 🧭 🔮 📰 🗟 👌 🕰	: 🔒 🕑 🖸	
🗀 🔒 🔣			
Message Name	Script Name	Scripts	
S1SetupRequest	S1APManagementHandler.gls	S1SessionControl.gls	Sequence
Reset	Reset.gls		C Random
PDN Connectivity Request	S1SessionControl.gls		< riandoin
Tracking Area Update Request	S1SessionControl.gls		
SERVICE REQUEST	S1SessionControl.gls		
			Un
			Down
		1	
		Add Delete	
Add Delete	Apply Scripts Clear Scripts		
		Initialisation Errors	Frror Events
			//

**Figure: Incoming Call Handler** 

## 🚳 GL Communications Inc.

### End-to-End VoLTE Call Emulation

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 below diagram. 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 emulate high volume calls with traffic. MAPS<sup>™</sup> HD RTP (PKS109) is a special purpose <u>rackmount network appliance with 4x1GigE NIC</u> 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, visit VoLTE Lab Test Suite webpage.



Figure: VoLTE Emulation using GL's Complete Wireless Lab Test Suite

#### LTE S1 Conformance Suite

MAPS<sup>™</sup> LTE S1 emulator can be configured as MME with a conformance script to emulate network side procedures conforming various success/failure test cases and automating the entire eNodeB (DUT) testing. This conformance test suite requires additional license (PKS154) to perform testing which allows user to test for selected testcase.

Following are the supported test cases -

- Paging success/failure
- Paging via IMSI success/failure
- UE attach success, UE detach, UE tracking area update
- Periodic updating
- Service Request
- E-RAB Setup procedures
- Setup context Fail, Success
- UE Context Release, Modification
- Handover success, failure S1 interface
- S1 Setup success, failure and resend setup
- Reset all resource, partial resource
- Error Indication
- Location report

### 🌑 GL Communications Inc.

#### LTE S1 Conformance Suite (Contd.)

Test cases include general Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP) messaging and call flow scenarios over LTE network. Logging and pass/fail results are also reported. Test cases verify conformance of various actions as listed above.



Figure: LTE S1 Handover Procedure Conformance

#### **Supported Protocols and Specifications**

Supported Protocols	Standard / Specification Used
S1 Application Protocol (S1-AP)	3GPP 36.413 9.0.0 (2009-09)
SCTP	RFC 4960
Non-Access-Stratum (NAS)	3GPP TS 24.301 V9.0.0 (2009-09)



## **Buyer's Guide**

Item No	Product Description
<u>PKS140</u>	MAPS <sup>™</sup> LTE S1 Interface Emulator
<u>ETH100</u>	Mobile Traffic - PacketCheck™
ETH101	MobileTrafficCore - GTP
ETH102	MobileTrafficCore - Gateway
<u>PKS154</u>	LTE S1 Conformance Test Suite
Item No	Related Software
<u>PKS127</u>	MAPS <sup>™</sup> IMS Emulator
<u>PKS139</u>	MAPS™ Diameter Emulator
<u>PKS142</u>	MAPS™ LTE eGTP (S3, S4, S5, S8, S10, S11 and S16) interfaces
<u>PKS164</u>	MAPS <sup>™</sup> UMTS Iu-PS Interface Emulation
<u>PKS160</u>	MAPS <sup>™</sup> UMTS Iu-CS and Iuh Interface Emulation

For more information, visit Signaling and Traffic Simulator webpage.



818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878, U.S.A (Web) <u>www.gl.com</u> - (V) +1-301-670-4784 (F) +1-301-670-9187 - (E-Mail) <u>info@gl.com</u>