

4G UE Emulator

Emulate 4G UE and generate realistic traffic towards the eNodeB



OVERVIEW

The Valid8 4G UE Emulator provides a cost-effective, scalable, solution for generating realistic UE calls in testing scenarios

WHAT IT CAN DO FOR YOU

The 4G UE Emulator solution is capable of simulating and testing several devices individually or in parallel. It is a scalable solution that enables the generation of up to hundreds of calls over the Uu interface. It is useful for eNodeB feature and capacity testing and any use case where real call generation is needed.

- It can simulate UEs
- It can test eNodeB

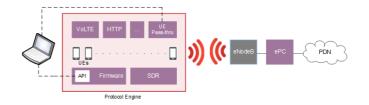
WHY IT'S DIFFERENT

It provides many advantages over using real UEs or basic simulators, including:

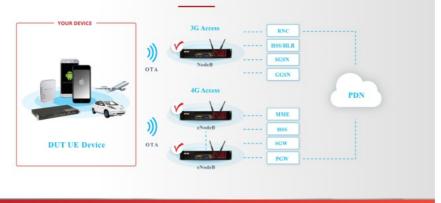
- Software based UEs are much more flexible in terms of adding new features than real UEs.
- Real UEs often become obsolete within a few years
- Easier to execute scripts over large numbers of virtual UEs than on real UEs
- The HW doesn't need to change when increasing the number of virtual UEs
- The band for software based UEs are fully configurable, unlike real UEs
- TCO (total cost of ownership) for software based UE solution is less expensive than real UEs

FEATURES

- Scalable architecture
- 3GPP release 8 12
- Includes PHY, MAC, RLC, PDCP, RRC, and NAS layers
- IP traffic generator (ping, UDP, HTTP)
- Supports Valid8 VoIP Load Tester (includes VoLTE)
- UE data pass-thru
- Automation API
- Voice Quality Measurement (VQM) for QoS
- FDD with half duplex or full duplex UEs
- TDD support now available



M3 UE Architecture





SUBSYSTEMS

The Valid8 4G Network Emulator is compromised of multiple subsystems that are available individually or in parallel, and are scalable to fit your needs. The individual emulators are controllable through their call controllers, and the traffic can be captured through use of a remote capture tool such as Wireshark.

• IeNodeB (femto, pico, or emulated)

91000

15000

1500

Attach Cstm (Next Call)

TAU (Next Call)

UE IPv6

- MME • SGW
- SGW
- OCS
- HSS
- PCRF
- ePDG

Events

1000

100

Attach Emerg (Next Call)

X2 HO S1 HO Hard Reset UE Service Req (Next Call) UE IPv4

Load Application

PUT /api/1/application/{PRODUCT}/{APPLICATION}/{CONFIGURATION}

Start

PUT /api/1/control/{ELEMENT}/start

Reset Report

DELETE /api/1/report

Get Events

GET /api/1/events

KPIs

- IS1 Attach Requests/Successes/Fails
- S1 Detach Requests/Successes/Fails
- S1 Dedicated Bearer Requests/Successes/Fails
- Current Active Sessions/ Bearers
- Number of Sessions/ Bearers Created
- S1 Attach Request Response Time
- S1 Dedicated Bearer Setup Request Response Time
- S1 Detach Request Response Time
- S1 Authentication Request Response Time
- S6a Authentication Request Response Time
- S1 Tracking Area Update Request Response Time

eNodeB Control

Active Calls	Call Attempts	Call Stops
min/avg/max 0.0/0.6	/1.0 0.00/sec	2 0.00/sec 1
eNodeB Scenario		
Attach Fails	Attach Requests	Attach Successes
	- 0.00/sec	2 0.00/sec 2
Detach Requests	Detach Successes	GTP U Session Duration
0.00/sec	1 0.00/sec	1 48989.0/48989.0/48989.0

Configurable Parameters

- Mobile Country Code
- Mobile Network Code
- eNodeB Type

eNodeB Controls

2 4 10

Start

Volume

Length

Gap

Stagger

30000

10000

Commands

Attach Std (Next Call)

- IP Addres S1 Interface
- IP Address eNodeB
- Primary DNS Address
- Secondary DNS Adress
- MAC Address Public Gateway
- GTP Tunnel IP Address and Port
- GTP Tunnel eNodeB IP Address
- Integrity Algorithm
- IP Address to assign UEs on LAN

"200010000000000":

},



AUTOMATION API

User commands can be fully automated using REST API. This includes performing all test control functions as well as collecting results and metrics.

GET /api/1/control {}	
GET /api/1/control {}	
GET /api/1/history {}	
GET /api/1/report {}	
PUT /api/1/application/fixed/networkTester/s	elftest {"traceFlags":319,"development":false}
Raw Close	

Load Application

PUT /api/1/application/{PRODUCT}/{APPLICATION}/{CONFIGURATION}

Start

PUT /api/1/control/{ELEMENT}/start

Reset Report

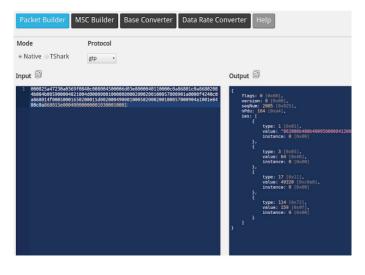
DELETE /api/1/report

Get Events

GET /api/1/events

SCRIPTING

The application's subsystems can be edited directly in the browser using Javascript or by using the graphical tools seen below. The Message Workshop allows for creating of test scenarios directly from the hex stream of a remote capture, while the Graphical Editor allows for creating customized call scenarios by dragging and dropping the call flow to meet your test needs.



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. Time	Source	Destination	Protocol	Info
366 11,767290	192.168.0.31	192,168,0,28	SNMP	get-response SNMPv2-SMI::enterprises.1
367 11.768865	192.168.0.28	192.168.0.31	SNMP	get-request SNMPv2-SMI::enterprises.11
369 11.775952	192.168.0.31	192.168.0.28	SNMP	get-response SNMPv2-SMI::enterprises.1
381 12.286091	192.168.0.28	192.168.0.1	DNS	Standard query A www.cnn.com
384 12.311862	192.168.0.1	192.168.0.28	DNS	Standard query response A 64.236.91.21
385 12.312727	192.168.0.28	64.236.91.21	TCP	56606 > http [SYN] seq=0 win=8192 Len=
386 12.361495 387 12.361583	64.236.91.21 192.168.0.28	192.168.0.28 64.236.91.21	TCP	http > 56606 [SYN, ACK] Seq=0 Ack=1 win 56606 > http [ACK] Seq=1 Ack=1 win=1753
388 12.361805	192.168.0.28	64.236.91.21	HTTP	GET / HTTP/1.1
389 12.413166	64.236.91.21	192.168.0.28	TCP	http > 56606 [ACK] Seg=1 Ack=845 win=6
390 12.413611	64.236.91.21	192.168.0.28	TCP	[TCP segment of a reassembled PDU]
391 12,414386	64.236.91.21	192.168.0.28	TCP	[TCP segment of a reassembled PDU]
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USE CASES

ENODEB UNDER TEST

In the scenario where the eNodeB is to be tested, it can be tested by the Valid8 4G Network Emulator emulating the core network. Additionally, load and conformance tests are available for interfaces S1-MME and S1-U. In the case where the eNodeB needs to be tested on the RF side, it can be tested by the Valid8 4G UE Emulator.

Supported Scenarios:

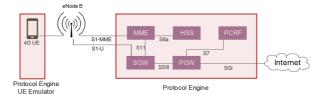
- IPower on / Start up
- 4 Attach
- 4 TAU
- 4 Attach
- 4 eRAB Setup
- 4 Detach
- UE Under

PCRF UNDER TEST

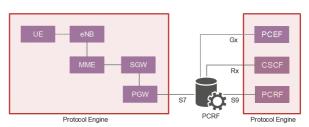
For testing the PCRF, the 4G Network Emulator can wrap around the PCRF with the core network and IMS.

Supported Scenarios:

- ICC-Request / Answer (CCR / CCA)
- 4 Re-Auth-Request / Answer (RAR / RAA)
- 4 Capability-Exchange-Request / Answer (CER / CEA)
- 4 Session-Termination-Request / Answer (STR / STA)
- 4 Abort-Termination-Request / Answer (ASR / ASA)
- 4 Device-Watchdog-Request / Answer (DWR / DWA)
- 4 Disconnect-Peer-Request / Answer (DPR / DPA)



- Emulates MME (for S1-MME) and SGW (for S1-U) along with all other needed core network elements, exposing all internal interfaces
- Conformance tests available for S1-MME, S1-U, and X2



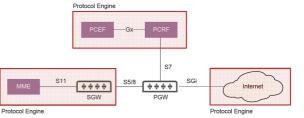
- IEmulates core network, Diameter, and IMS nodes as needed for testing the PCRF, exposing all internal interfaces
- Conformance tests available for each interface (S7, S9, Rx, Gx)

PGW UNDER TEST

For testing the PGW, the 4G Network Emulator can wrap around the node using the S5/8, S7, and SGi interfaces. Traffic can be originated from real or emulated UE and IoT devices.

Supported Scenarios:

- ICreate Session
- 4 Delete Session
- 4 Create Bearer
- 4 Modify Bearer
- 4 Delete Bearer
- 4 Echo



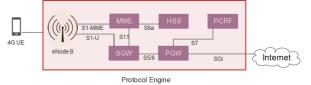
- DEmulates all required nodes for wrapping around, including MME and PCRF for testing over interfaces S5/8, S7, and SGi
- Exposes all internal interfaces
- Conformance tests available for each interface (S5/8, S7, SGi)

UE UNDER TEST

For testing UE or IoT devices, the 4G Network Emulator can provide the entire 4G core network as well as an emulated or real eNodeB depending on your test needs.

Supported Scenarios:

- IPower on
- 4 Attach
- 4 Detach
- 4 TAU
- 4 Data Connection
- 4 VoLTE Call



- IEnd to end VoLTE test capability
- Includes real femto, pico, or microcell eNodeB
- Emulates all core network nodes and allows for data connection to external networks



SUMMARY OF SPECIFICATIONS

The Valid8 4G Network Emulator is capable of simulating and testing several devices individually or in parallel and is scalable to fit your needs.

SPECIFICATIONS

Protocols	I3GPP TS 23.401 (EUTRAN) 3GPP TS 24.301 (NAS) 3GPP TS 29.274 (GTPv2-C) 3GPP TS 29.274 (GTPv2-C) 3GPP TS 29.281 (GTPv1-U) 3GPP TS 36.413 (S1AP) 3GPP TS 36.414 (S1-U) IETF RFC5246 (TLS, Protocol (10, 11, 12)) IETF RFC6101 (SSL, Protocol Version 3.0) IETF RFC793 (TCP) IETF RFC793 (TCP) IETF RFC796 (UDP) IETF RFC796 (UDP) IETF RFC796 (UDP) IETF RFC791 (IPv4) IETF RFC791 (IPv4) IETF RFC311 (SRTP) IETF RFC1035 (DNS) IETF RFC2350 (RTP/RTCP) IETF RFC3261 (SIP)
UE	IInternal femtocell: 400 - 6000 Mhz; including Bands 1 - 44 plus unlicensed 5Ghz band and others Includes CBRS band Duplex: FDD & TDD Interface Uu to UE SIMs are software-based and configurable
UEs Emulated	IScalable; up to 256 per unit
UE Configuration	IIMSI IMEISV Secret key UE category Duplex mode Default APN Tunnel setup script Power on/off via script Simulation on user plane
Scenarios	IHTTP Ping Flooding VoLTE
МІМО	I2X2; requires additional Valid8 unit with RF module



PRODUCT DETAILS

Hardware	IIntel-based; scalable to meet performance needs
Options	IP5088/01 includes base kit (simulated eNB) P5089/01 includes LTE pico eNB (single band) P8110/02 includes LTE femto eNB (multi band) Conformance tests available for each interface (S1, S5, S6a, S7, S11, Rx, Gx, Gy, Ro)
Operating System	IProtocol Engine (Linux-based)
User Interface	[®] Browser-based, touch-optimized graphical user interface
Automation	OHTTP API
Max output power	131 mW (femto RF module option) 1000 mW per Tx (exernal picocell option)
Connector types	IFemtocell: SMA female Picocell: N-type female
Hardware dimensions	0M1: 4.5" x 4.5" x 1.75" M3: 19" x 15.75" x 3.5"; appx. 16.7lb
Power supply	IM3: 520W AC to DC, 100 - 240v