SIMNOVUS

UE SIMULATOR

Data Sheet

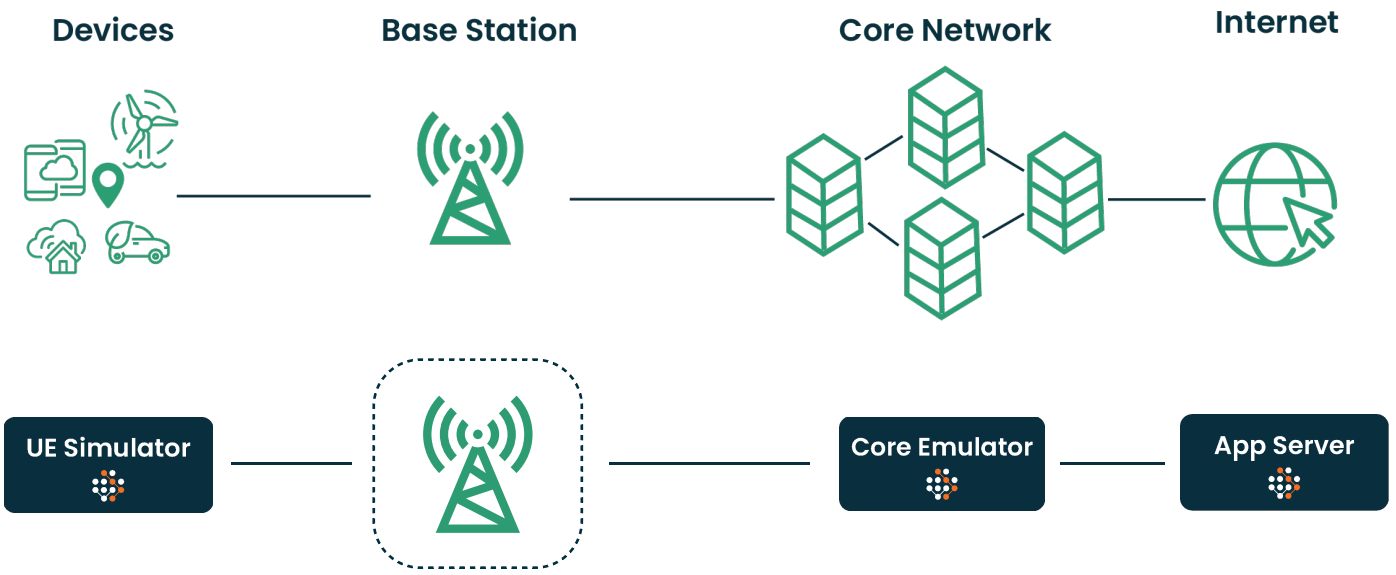
OVERVIEW

Validate 5G RAN Functionality and Performance

The Simnovus UE Simulator, brings a software mindset to validating 5G/4G base station functionality, capacity, and reliability. Our highly intuitive web-based application leverages commercial off-the-shelf (COTS) hardware with software-defined radio (SDR) to enable ubiquitous, automated, and simplified validation.

The UE Simulator enables performance, load, and capacity testing over the radio interface for various validation needs including massive connectivity, high throughput, and complex signaling procedures, using 4G and 5G real-life scenarios and realistic traffic mixes.

Take validation to the next level with extensive capabilities to create realistic test scenarios in the lab to accelerate base station innovations.



Leverage wrap-around configuration for targeted base station testing.

Accelerate Deployment

With our UE Simulator, automation is built in for Continuous Integration/Continuous Development (CI/CD). Scripts are auto-generated with a powerful and flexible web-based user interface (UI), allowing for CI/CD and eliminating the need to write your own scripts. The UE Simulator includes a rich set of prepackaged automation libraries ready for integration.

Simplify Testing and Get to Market Faster

Significantly reduce 5G/4G base station validation time with our plug-and-play UE Simulator that helps you ramp up quickly and easily isolate data needed to debug faster. Get extensive statistics and correlation across protocol layers and dynamic log levels that are automatically adjusted based on user-defined triggers. Or filter data—like IQ samples—and export for analysis with third party tools.

Our UE simulator software runs on COTS and SDR systems, enabling the deployment of multiple test beds without having to spend millions on Capex. Parallel testing can save your team time and effort when executing automated tests.

Use Core Emulator for Wrap-around Validation

The Simnovus Core Emulator also runs on COTS and allows the tester to simulate EPC, 5GC, and IMS Core in a box in a wrap-around configuration to eliminate dependencies on the real core network and IMS Core. It supports the various UE and network initiated control procedures as well as data and Volte/VoNR traffic over LTE S1 and 5G N1/N2 and N3 interfaces. Supported procedures include configuration updates, PDU session management, UE context management, and mobility operations.

The Core Emulator provides full logging of decoded N1/N2 protocol stack messages as well as a set of comprehensive call- and event-level statistics to assist with troubleshooting issues. Refer to the specifications section for a summary of features supported by our Core Emulator.

FEATURE SUMMARY

Runs on COTS	Simulates hundreds of UEs on a single x86 platform; scale up horizontally, quickly, and efficiently
Multi-Purpose	Enables functional, interoperability, and load testing on the same platform
Multi-Technology	Simulates 5G, Nb-IoT, and LTE UE categories
Multi-Topology	Validates O-RAN systems in isolation or in end-to-end (E2E) configuration
Channel Modeling	Tests link adaptation by varying channel conditions
Realistic Traffic Mix	Combines UE procedures with a large variety of data and Volte/VoNR traffic
Advanced Troubleshooting	Provides multi-layer logging and multi-level statistics with correlation

KEY BENEFITS

Enables Parallel Test Beds

Software on COTS enables parallel test beds to accelerate validation

No Expensive Capex

Flexible subscription enables broad coverage without millions in Capex

Quick Ramp Up

Packaged tests and intuitive workflows ensure fast and robust validation

2x Faster Troubleshooting

Comprehensive multi-layer logging and multi-level statistics ensure faster problem isolation

100% Automation on Day 1

Packaged scripts and RESTful APIs facilitate out-of-the-box automation and CI/CD acceleration

UE SIMULATOR SPECIFICATIONS

Simulated UEs/Cell	5G (up to 256), LTE (up to 1K), Nb-IoT (up to 4K)
Supported Cell/System	5G – up to 2; 4G – up to 4
3GPP Release	Rel. 15
UE Categories	5G, NB-IoT (NB1, NB2), Cat-M1, LTE (0-13)
5G Deployment Modes	NSA and SA
Supported Frequency Bands	FR1 (70 MHz to 6.0 GHz)
Channel Bandwidths	Up to 100 MHz
Sub-Carrier Spacing	15, 30, 60 KHz
Antenna Configuration	SISO, MIMO (2x2, 4x4)
Carrier Aggregation	5G - 2CC, LTE - 3CC
Handovers	Inter/intra-frequency, inter-duplex, Inter-eNB/gNB, intra-eNB/gNB
QAM	QPSK, 16 QAM, 64 QAM, and 256 QAM
UEs/TTI	8
2x2 MIMO 2CC Support in 100MHz	Supported
4x4 MIMO 1CC Support in 100MHz (UL - 2 layers)	Supported
Channel Emulation	AWGN, 3GPP channel models (AWGN, EPA, EVA, ETU, TDL: A/B/C)
Power Control	UL Power Control, PHR, TPC
Logging	All layers (L1, L2 and L3), SIP
Dual Stack UE	Supported
VoLTE/VoNR	Supported with per-UE MOS calculation
Other Application Traffic	Fixed payload UDP and TCP data, non-IP data, FTP, ICMP PING External IP generator
Automation	RESTful APIs

CORE EMULATOR SPECIFICATIONS

EPC Specifications	
Network elements	Mobility Management Entity (MME), Serving Gateway (SGW), Packet Data, Network Gateway (PGW), and Home Subscriber Server (HSS) Evolved Packet Data Gateway(ePDG), Policy and Charging Rules Function (PCRF) and Equipment Identity Register (EIR) all integrated within the same software component
3GPP release	Release 16
NAS encryption and integrity protection	AES, SNOW3G, ZUC
USIM authentication	XOR, Milenage, TUAK
IP version	IPv4 and IPv6
QoS	Support of all LTE QCIs as well TFT and dedicated bearers
Handover	Intra-MME and and EPS 5GS IRAT handover support
Network interfaces	S1AP and GTP-U to eNodeB Rx to external IMS server, S6a to external HSS S13 to external EIR, SGsAP to external VLR/MSC SBcAP to external CBC
RAT	NR, LTE, NB-IoT
CIoT features	control plane CIoT optimization, Non IP data delivery, Attach without PDN connectivity
Power saving features	PSM and extended DRX

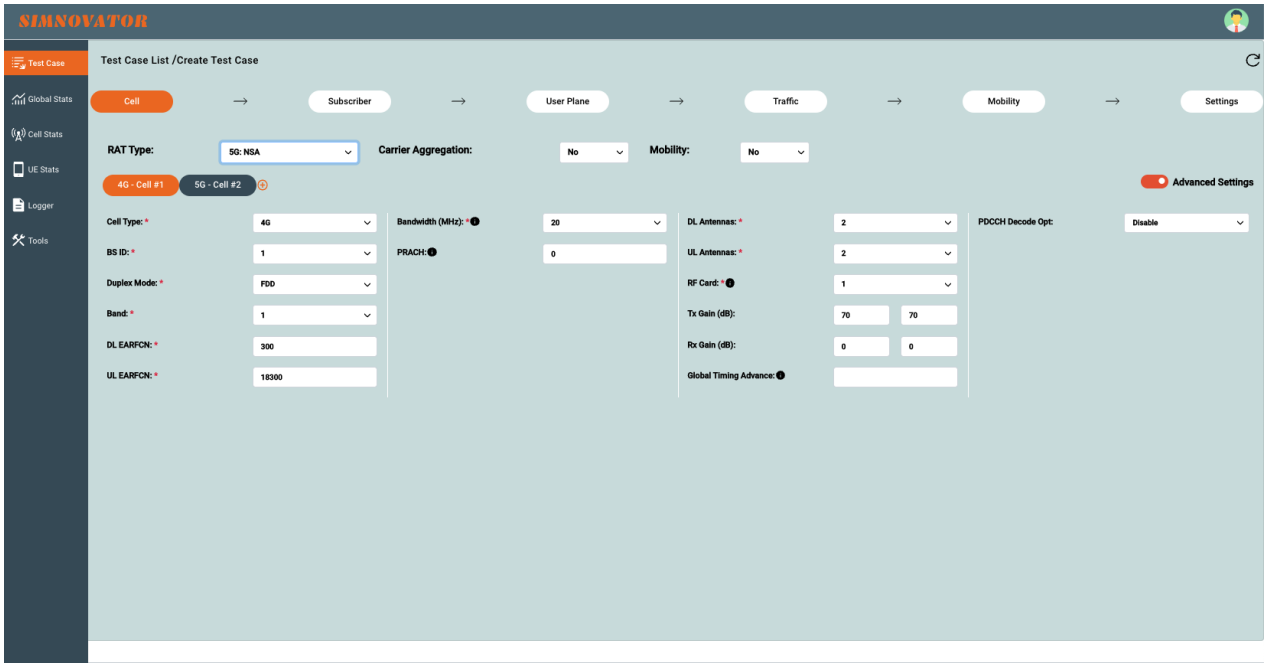
Core Emulator Specifications Cont.

5GC Specifications	
Network elements	Access and Mobility Management Function (AMF), Authentication Server Function (AUSF), Session Management Function (SMF), User plane Function (UPF), UDM (Unified Data Management) 5G-EIR (5G Equipment Identity Register) all integrated within the same software component
3GPP release	Release 16
NAS encryption and integrity protection	AES, SNOW3G, ZUC
USIM authentication	XOR, Milenage, TUAK 5G-AKA
IP version	IPv4, IPv4v6, IPv6 and unstructured PDUs support
QoS	Configurable QoS flows
PDU	Multi PDU sessions support
Network interfaces	NG interface (NGAP and GTP-U protocols) to several gNodeBs, ng-eNodeBs or N3IWFs Rx to external IMS server, N12 to external AUSF N8 to external UDM, N17 to external 5G-EIR, N50 to external CBC
RAT	NR, LTE, NB-IoT and non-3GPP RAT
Handover	intra-AMF and 5GS EPS IRAT support

Core Emulator Specifications Cont.

IMS Core Specifications	
Network Elements	Proxy-CSCF (P-CSCF), Interrogating-CSCF (I-CSCF), Serving-CSCF (S-CSCF), and Home Subscriber Server (HSS) all integrated within the same software component
ISIM authentication	XOR, Milenage, TUAK
Security features	MD5, AKAv1 and AKAv2 for authentication and IPSec at transport level
Network interfaces	Rx interface for support of precondition and dedicated bearer Cx interface for external authentication
IP versions	IPv4 and IPv6
Services	Voice call, Video call, Voice echo test, Call hold, SMS over SIP and SMS over SG

FUNCTIONAL OVERVIEW



Generate complex test profiles in minutes with our step-by-step-test creation wizard.

Intuitive Web Interface

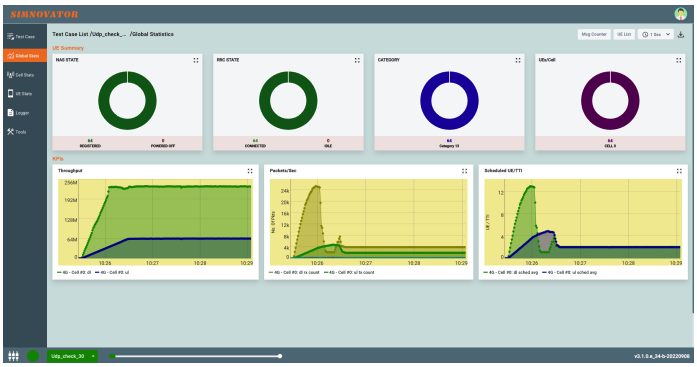
With Simnovus's web graphical user interface (GUI), there is no need to install any client software to use the UE Simulator. Plus, once you upgrade the server, all users will have direct access to the latest software by simply logging in on their usual browser.

Simplified Test Configurations

The UE Simulator has an intuitive step-by-step workflow to walk users through the generation of even the most complex test profiles in just a few minutes. For more customized validations, users can easily edit our library of prepackaged tests. A variety of configurations are readily available, including multi-UE test cases with mobility scenarios and channel models.

Extensive Statistics

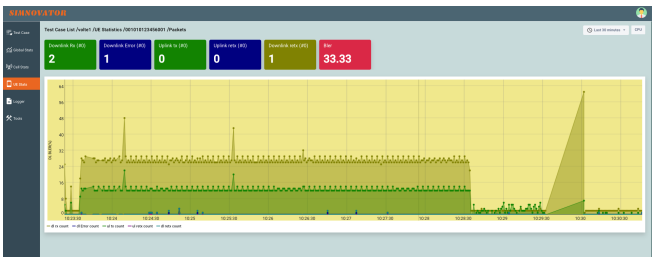
Simnovus provides a wide range of key performance indicators (KPIs) at the global scale and allows users to drill down to per cell and per-UE levels. Examine current values and data over time for trend analysis.



Examine trends with global statistics.

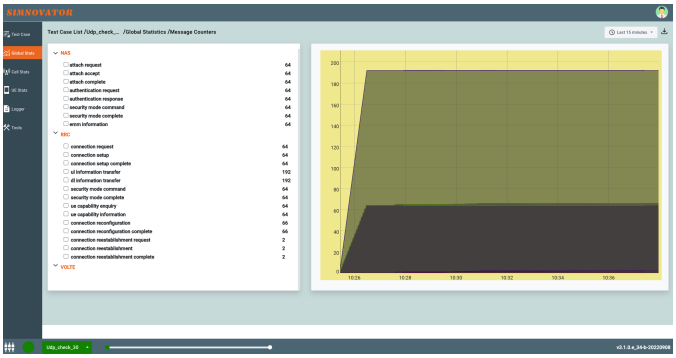
Extensive Statistics Cont.

Compare various uplink and downlink statistics for visual analysis and troubleshooting.



Drill down to per-cell and per-UE level statistics.

In addition, users have access to various message counters at the protocol level, including NAS- and RRC-layer messages.



Access layer-by-layer message counters.

Detailed Logging and Troubleshooting

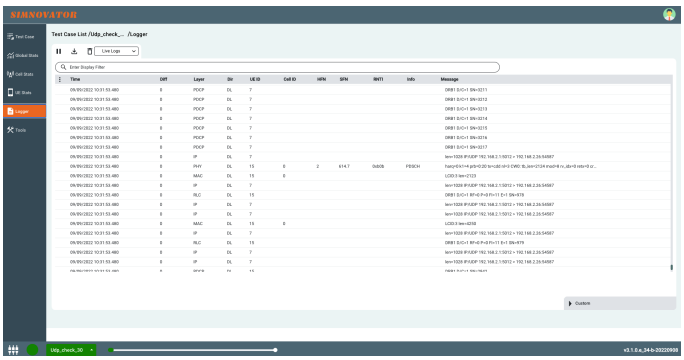
To help users analyze base station behavior, the UE Simulator provides advanced logging and troubleshooting capabilities.

Key logging capabilities include:

- View detailed logging of all layers (PHY, MAC, RLC, PDCP, RRC, NAS)
- Selectively enable or disable logging of a layer
- Choose log level for each layer of the stack
- Filter logs for a particular UE or cell
- Switch from detailed decoding of NAS and RRC messages to logs of all PHY layers
- Save logs in text or graphical format for offline analysis

Key troubleshooting tools include:

- Constellation plot
- Resource allocation map
- Spectrum analyzer
- System resource utilization



Detailed layer logging.

HARDWARE REQUIREMENTS

The Simnovus UE Simulator solution runs on COTS hardware and comprises the following components:

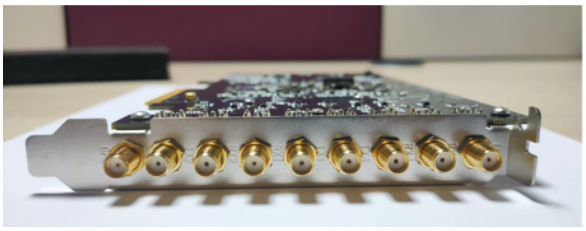
Manager: GUI and controller node running on a VM.

UE Simulator*: Simnovus currently ships the server pictured. The server can house one or two SDR cards.
**Simnovus supports other options of COTS hardware such as Dell XPS8950 and Dell R750 for load test configurations up to 256 UEs in 4x1 carrier*

App Server: Application server for terminating user plane traffic.

Core Emulator: Emulates EPC and 5GC for base station wrap-around configuration

UE Simulator platform



SDR cards

SDR Specifications

- RF power output: <10 dBm
- Max RF input power: -10 dBm
- 4 SMA female (TX1, TX2, RX1, RX2), AC coupled
- 1 SMA female (GPS antenna with 3.3V DC power supply)
- PCIe full height, short length

HARDWARE SPECIFICATIONS

UE Simulator (Provided by Simnovus)	Manager (Provided by Customer)	App Server/Core Emulator (Provided by Customer)
COTS hardware	Virtual Machine	COTS hardware
CPU: Intel i9	CPU: Intel i5 or higher	CPU: Intel i5 or higher
Clock speed: Max turbo frequency 4.60GHz	Clock frequency: 3.3GHz or higher	Clock frequency: 3.3GHz or higher
Number of cores: 18	Number of cores: 4 or more	Number of cores: 4 or more
RAM: 4 x 8GB DDR4	RAM: 8GB or higher	RAM: 8GB or higher
OS: Ubuntu 20.04	OS: Ubuntu 20.04 or higher	OS: Ubuntu 20.04 or higher
Disk space: 1TB	Disk space: 500GB or more	SDD: 500GB or more
NIC ports: dual Intel 2.5G Ethernet	NIC port: 1 x 1GbE	NIC ports: • 1 x 10GbE for traffic • 1 x 1GbE for management
PCIe Gen 3 slots: 7		

ORDERING INFORMATION

The Simnovus flexible all-inclusive licensing provides simplified ordering:

Step 1:

Select number of UEs (64, 128, or 256) for software license.

App server software is also included.

Step 2:

Select number of SDR cards (1 or 2) to ship with server.

Step 3 (Optional):

Select Core Emulator for software license.

Get started today!
Contact **sales@simnovus.com.**

This information is subject to change without notice.

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