DATASHEET

SIMNOVATOR®

The UE Simulator on COTS

4G & 5G UE SIMULATOR

SEPTEMBER 2020

SIMNOVUS
innovation made simple

INTRODUCTION

Simnovator, the Simnovus UE Simulator is the most cost-effective and feature-rich simulator to validate the functionality, capacity and the reliability of the 4G and 5G base stations. It helps to effortlessly recreate many realistic scenarios. With the support of dual radios (4G and 5G) on the same system concurrently, the ability to simulate all types of UE categories, extensive statistics, elaborate logging capability and the ability to automate tests; it is suitable for both the development and the quality assurance team of an organization.

The latest release already supports both the 5G NR Non-Standalone (NSA) and Standalone (SA) mode with the support of 100 MHz channel bandwidth.

The solution is based on Software Defined Radio (SDR) and hence a Commercial Off the Shelf (COTS) hardware is sufficient to run the solution. Up to 5 PCIe based Radio Front-end (RF) cards can be fit into the hardware to verify multi-cell scenarios.

Each card has a maximum of 4 Tx and 4 Rx ports to support up to a 4x4 MIMO (Multiple Input and Multiple Output) configuration. For tests that require antenna configuration more than that, multiple RF cards can be used per cell. Multiple cells or base stations can be connected to validate advanced test scenarios like mobility and carrier aggregation. Tests can be conducted on both RF cabled as well as Over the Air (OTA) mode.

THE COST-EFFICIENT UE SIMULATOR

Key Benefits:

- **Reduces CAPEX**: available on COTS with Software Defined Radio RF cards
- **Increases Productivity**: parallel test beds for concurrent validation
- **Easy troubleshooting**: detailed logging for all layers with key KPIs to watch
- **Regression testing**: easy automation framework to schedule repeated tests
- **Short learning curve**: Intuitive web-based user interface with extensive stats
- **Future Proof**: use CPRI or upgrade from 50MHz to 100 MHz on the same server

KEY BENEFITS

SIMPLIFYING COMPLEX VALIDATION PROCESS

COST - EFFICIENT

SIMPLIFIED LICENSING

REALISTIC TRAFFIC

No more expensive and bulky racks of proprietary hardware that obsoletes after a few years. Don't rely on a single test equipment and time share it by multiple teams.

Switch to the futuristic and cost-effective UE Simulator and equip each team with its own copy of the Simnovator. Run many parallel test beds at the same cost and accelerate the product development and validation cycle.

Execute a variety of tests (functional, regression, performance & negative) on the same system and share tests across teams to identify and solve problems faster.

Get a single license and simulate 4G, Nb-IoT, Cat-M, and 5G UEs. Opt to start with a 4G license to verify LTE + CAT-M + NB-IoT co-existence. Upgrade to 5G and get capability to verify Non-Standalone (NSA) and Standalone (SA) configurations.

Bands are not separately licensed. Easily configure and operate on any of the FDD and TDD bands. Whether it's the CBRS band or any custom band, we got you covered.

The licensing is based on the number simulated UEs. Begin with a 64 UE license and upgrade to 128, 256, 512, or up to 1000 UEs. All the features remain intact.

Advanced features with the ease of configuration, makes the verification of the performance and the reliability of base stations feasible.

The ability to verify mobility scenarios by simulating UEs at near, far, and middle of the cell coverage area, defining the mobility path of UEs from cell A to cell B, makes it convenient to recreate scenarios like the bounce and return, mobility profiles like pedestrian or vehicular.

Combine it with the VoLTE/VoNR calls and check the impact of handover on the voice quality.

SUPPORTED FEATURES

Feature	Description
UE Categories	5G, NB-IoT(NB1, NB2), Cat-M1, LTE(0-13)
Simulated UEs/cell	5G (up to 256) LTE (up to 1K), Nb-IoT (up to 4K)
Supported cells/system	5G (up to 2) 4G (up to 5)
5G Deployment Modes	Non-Standalone Mode & Standalone Mode
Supported Frequency Bands	FR1 (70 MHz to 6.0 GHz)
Channel Bandwidths	up to 100MHz
Sub Carrier Spacing	15, 30, 60 KHz
Antenna Configuration	SISO, MIMO (2x2, 4x4)
Carrier Aggregation	5G - 2CC, LTE - 3CC
Handover	Inter/intra-frequency, inter-duplex Inter-eNB/gNB, intra-eNB/gNB
QAM	UL: 64, 256, DL: 64, 256
Channel Emulation & Power Control	AWGN with user-defined velocity UL Power Control, PHR, TPC
Detailed Logging	All layers (L1, L2 and L3)
Application traffic	VoLTE, VoNR, FTP, HTTP Fixed payload UDP traffic, non-IP data
Automation	Supported with run-time interaction

INTUITIVE USER INTERFACE

Browser Based Interface

Simnovator can be securely accessed from any computer in the network by using web browsers like Chrome and Firefox. This eliminates the need to install the client application on the end user's computer and the hassle of updating them during major upgrades of the software. Upgrade only the server and all the users get access to the latest and greatest features.
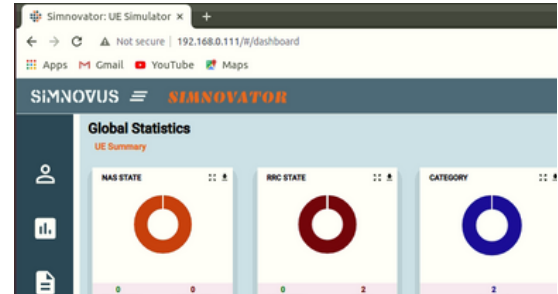
User Management

User management is smoothly handled using the administrators panel where password and access restrictions can be controlled. Managers can get complete visibility of the test status.

Multiple users can access the system simultaneously. While one user performs a live test, another user can create new profiles, view offline logs or view the ongoing logs and statistics as well. This will improve the productivity where a set of engineers create test cases, where another set of engineers can execute them.

Test Profile Creation

No matter how complex your test scenario is, Simnovator's clean and intuitive user interface will help you define them efficiently. Validate scenarios like

- UEs across multiple cells
- UEs with multiple user plane profiles
- different segments of UEs with different behavior
- mobility scenarios
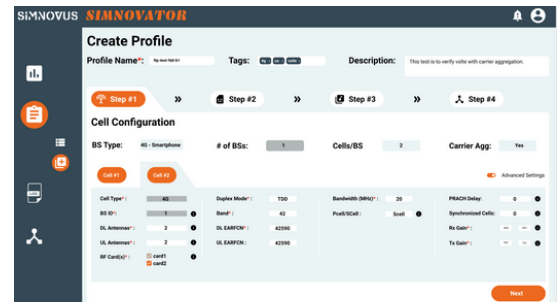
Create them with ease and choose them quickly with easy tagging to execute them in the future.

Detailed Logging

Whether you are verifying a feature or you are troubleshooting an anomaly in the behaviour of the base station; the extensive logging available in Simnovator makes it easier.

- Detailed logging supported for all the layers (PHY, MAC, RLC, PDCP, RRC, NAS).
- Selectively enable or disable logging of a layer
- Choose the log level for each layer of the stack;
- Filter logs for a particular UE or a cell;

You can easily switch from the detailed decoding of the NAS and RRC messages to the logs of all the PHY layers. In addition to this, you can save the logs in text format as well as in the graphical format for offline analysis.
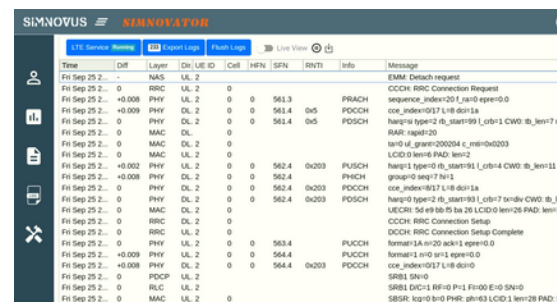
ELABORATE STATISTICS

Simnovator provides a wide range of key metrics on the dashboard. Choose between multiple views
- global view,
- cell view or
- UE view.

Every view provides comprehensive KPIs and counters to easily check whether the test expectations are met. Selectively check if a particular UE or UE category gives different results compared to the rest.

Drill down to specific KPIs like throughput, packet/sec etc. See the trend over a period of time
- current view
- since N hours
- since beginning of the test

Either look at all the values at one go or selectively see the trend of one value compared to the other to analyze the impact of one on the other.

This comparative analysis helps in troubleshooting the problems faster.
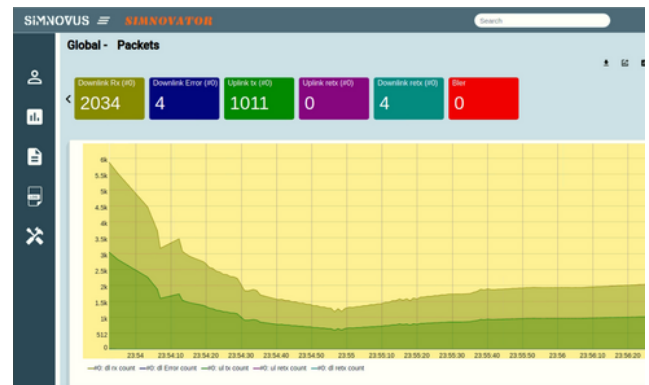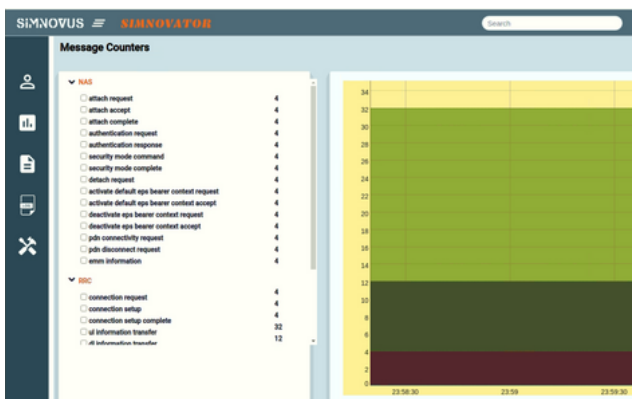
The message counters gives you a detailed count of all the messages of the following types
- NAS (4G and 5G)
- RRC (4G and 5G)
- VoLTE (SIP)

These values can be used to effectively calculate multiple metrics e.g. Attach Rate, PDN connectivity rate, Detach rate to name a few.

Plot these counters over a period of time to see if the values step up as expected or they show a sudden spike.

Simnovator provides many more graphical tools which help in the analysis of the test.
- constellations plot
- resource allocation map
- in-built spectrum analyzer
- system resource utilization

HARDWARE

COTS Hardware

Simnovator is based on the Software Defined Radio (SDR) technology. All the layers including the PHY layer are handled in software which makes it possible to be run on an x86 processor based Commercial Off The Shelf (COTS) hardware.

For simple configurations, you can choose your own hardware. However, for complex and advanced configurations (e.g. multi cell carrier aggregation, 100 MHz bandwidth), we recommend customers to purchase Simnovator with the hardware the we provide.

Fig: front view

At Simnovus, we benchmark the solution on different platforms to identify the best configuration. At present, the solution provided by us is powered by the following

Processor:
- Max Turbo Frequency: 4.5 GHz
- # of Cores: 14

RAM:
- 16 GB

Diskspace:
- 1 TB

PCIe Slots:
- 6 x PCIe Gen3.0

LAN:
- 2 x 1GbE ports

Fig: back view
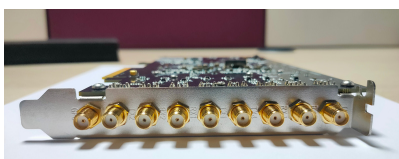

Fig: Multiple SDR cards fitted in the server

Fig: 100 MHz card with 4x4 configuration

SDR Cards
There are two variants of the SDR card. One which has a max channel bandwidth of 50 MHz and the other of 100 MHz.

The specifications of the cards are mentioned below.
- RF coverage: 70 MHz to 6.0 GHz
- RF bandwidth: < 200 kHz to 100 MHz
- RF power output < 10 dBm
- Max RF input power: -10 dBm
- up to 4x4 RF transceiver with integrated DACs and ADCs
- up to 8 SMA female (TX1, TX2, TX3, TX4, RX1, RX2, RX3, RX4)
- 1 SMA female (GPS antenna with 3.3V DC power supply)

ADD-ON PACKS

SIMNOVATOR®-ESSENTIALS

Simnovator Essentials is the add-on pack to the Simnovator UE simulator. This comes in different forms to simulate different types of user plane traffic patterns. It is an essential component of Simnovator to make it a true simulator that mimics the behavior of the real world.

Starting from the stateless UDP traffic profile to more complex user plane profiles like that of sensors, or smartphones doing VoLTE or VoNR calls or consuming Over The Top (OTT) services like streaming video or messaging, Simnovator-Essentials will cover all your needs.

Simnovator-Media
The Simnovator-Media pack provides the voice capability (VoLTE or VoNR) to the simulated LTE, Cat-M, or 5G NR UEs. Easily simulate conversational voice services with the following options.

- AMR-WB and AMR-NB codecs in mono and stereo mode
- Global and per UE statistics
- Accurate MOS score
- Packet drops, delay, and jitter
- Fully decoded SIP, RTP, and RTCP messages

Combine this with other add-on packs and recreate realistic traffic scenarios.

Simnovator-Web
The Simnovator-Web pack comes pre-loaded in the Simnovator. This pack provides the majority of the web traffic patterns that originate from the smartphones in the 4G network and potentially from the 5G networks. They are
- File Transfer Protocol (FTP, FTPS, SFTP, SCP)
- HTTP, HTTPS
- Email protocols i.e. SMTP and IMAP

Along with this, if the user wants to generate fixed TCP or UDP traffic, it allows users to specify the packet size, inter-pkt delay etc.

Contact us at sales@simnovus.com to share the requirement and book the online demo of the product.