SiMNOVUS

Simnovus
Network Emulator

The Complete UE Validation Solution

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Your Plug-and-Play Path to Faster UE Validation

The Simnovus Network Emulator is a one-stop solution for validating the performance and functionality of NR, LTE, LTE-A, LTE-M, and NB-IoT devices.

Our emulator acts as a 3GPP-compliant eNodeB, ng-eNodeB, gNodeB, EPC, and 5GC, supporting features like NTN, RedCap, VoLTE/VoNR, and eMBMS.

Powered by deployment-quality LTE and NR software, the Network Emulator offers the same functionalities as a real network, but with unmatched flexibility and cost savings.

Here's what sets us apart:
- **Plug-and-Play Simplicity**: Get started quickly with minimal configuration.
- **Fast Isolation & Debugging**: Isolate issues and debug faster with in-depth data analysis.
- **Extensive Statistics & Correlation**: Gain valuable insights across protocol layers.
- **Reduced Capex**: Run multiple testbeds on standard servers with SDR cards.
- **Parallel Testing**: Save time and effort by running automated tests simultaneously.

Complete Network in a Box
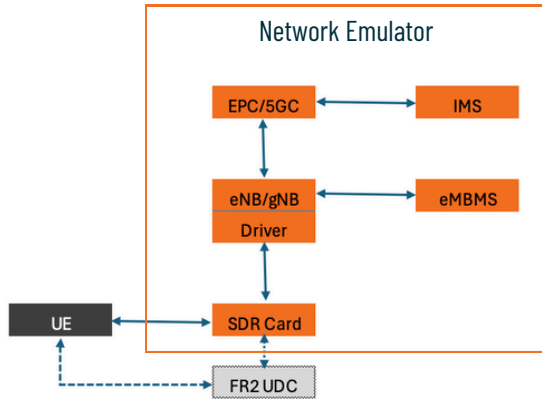
The Simnovus Network Emulator offers a comprehensive testing environment within a single, convenient unit. It eliminates the need for complex network setups, functioning as a complete **network "in a box."**

The emulator contains all essential components for UE connectivity, including Radio Access Network (RAN) elements, 4G and 5G core networks, an IMS core for voice and messaging services, and an eMBMS Gateway for multimedia broadcast messaging. It can communicate with external public networks for internet services.

The Software Defined Radio (SDR) provides exceptional flexibility, enabling operation across any frequency band within the FR1 range. For scenarios requiring mmWave connectivity, an optional Up Down Converter (UDC), part of the FR2 package seamlessly expands the emulator's capabilities to support mmWave UE testing.

This comprehensive and adaptable solution empowers efficient and thorough device validation.

Key Features

Multi-RAT Support
Validates UEs supporting multiple radios 5G (SA/NSA) LTE, NB-IoT or Cat-M

Support of NTN and RedCap
Advance Release 17 feature support along with realistic satellite simulation to verify NTN capabilities.

Massive UE Support upto 1000
Scales to support up to 1,000 concurrent UEs (varies by model and configuration).

Handover
Supports intra-handovers (within a single emulator unit) and inter-handovers (between two units).

Carrier Aggregation
Supports carrier aggregation of multiple TDD/FDD LTE and NR FR1/FR2 cells.

VoNR/ViNR
Supports VoLTE, ViLTE, VoNR, ViNR, SMS, and emergency call testing with an integrated IMS server.

High-throughput testing (up to 9 Gbps DL/1 Gbps UL)
Achievable speeds depend on your emulator configuration and UE capabilities.

Realistic channel emulation
Supports various DL channel conditions based on 3GPP specifications (36.101 & 38.141)

Deep protocol insights
Gain granular visibility into LTE and NR protocols with selective logging, layer-by-layer displays, and insightful graphs and analytics.

Streamlined automation
Extensive API simplifies test automation by enabling remote control of all nodes in the box.

New Features

Non Terrestrial Networks

- **Non-Terrestrial Network (NTN) Support (Release-17):** Validate NB-IoT and NR cell behavior in LEO, MEO, and GEO satellite configurations.
- **Advanced Satellite Channel Simulation:** Simulate large Round-Trip Time (RTT) delays, Doppler shift, and attenuation specific to NTN operation.
- **Flexible Ephemeris Configuration:** Configure satellite positions using industry-standard TLE or StateVector files, or define custom orbital elements.

Reduced Capability (RedCap)

- **UE Access Control:** Granular control over allowing 1 or 2 receiver User Equipment (UE) access within the cell.
- **Half Duplex Flexibility:** Enable or disable half duplex mode for the cell, catering to specific testing scenarios.
- **RedCap Configuration:** Define customized initial Downlink (DL) and Uplink (UL) Bandwidth Parts (BWPs) tailored for RedCap testing.

Flexible Network Emulator Options To Meet Your Validation Needs

Simnovus offers a range of Network Emulator configurations to perfectly match your User Equipment (UE) category and throughput requirements. All options leverage the same powerful software base, ensuring seamless operation and familiarity.

Select the ideal option for your current testing needs. Easily scale your setup up or down as your requirements evolve. With a simple license switch and the addition or removal of SDR cards, you can adapt your testing environment on the fly.

This flexible approach allows you to:
- **Optimize costs:** Pay only for the capabilities you need at any given time.
- **Future-proof your investment:** Easily adapt your setup for new testing demands.
- **Simplify upgrades:** Leverage the existing software base for a smooth transition.

Ultimate

Advanced

Classic

Mini

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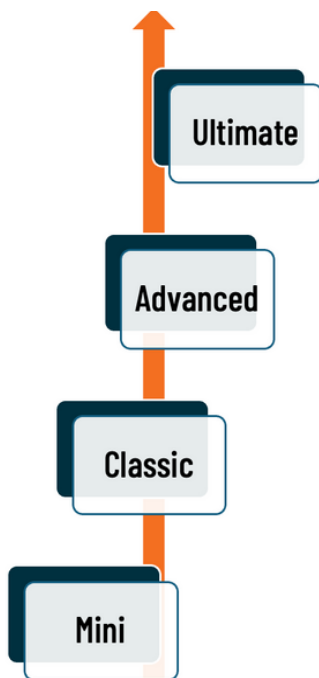
"This network emulator is a lifesaver! Started small, easily scaled up with my needs. No more equipment headaches, just smooth sailing. Makes testing fun again!"

Choose the Model that Fits Best

Features	Mini	Classic	Advanced	Ultimate
LTE	Y	Y	Y	Y
5G NSA	N	Y	Y	Y
5G SA	Y	Y	Y	Y
NB-IOT, Cat-M	Y	Y	Y	Y
Support of FR1	Y	Y	Y	Y
Support of FR2	N	N	Y	Y
Max Channel BW (in MHz) per cell	20	50	100	100
Max SDR Cards	1 x SDR50	3 x SDR50	2 x SDR100	4 x SDR100
Max No of cells 2x2 MIMO or SISO	1	3	4	8
Max No of cells 4x4 MIMO	0	0	2	4
Max Concurrent UEs	500	1000	1000	1000
Throughput (DL, UL)	DL: 200Mbps UL: 75 Mbps	DL: 600Mbps UL: 210Mbps	DL: 3 Gbps UL: 2 Gbps	DL: 6 Gbps UL: 2 Gbps

Configuration Possibilities

Mini	Classic
4G LTE • 1 cell 20 MHz 2x2 5G NR SA Mode • 1 cell 20 MHz 2x2 or 40 MHz SISO NB-IOT • 1 NB-IoT cell in standalone, in-band or guard-band mode LTE-M • 1 LTE cell with CAT M1 support	4G LTE • 3 cells 20MHz 2x2 • 1 cell 20 MHz 4x4 + 1 cell 20MHz 2x2 5G NR SA Mode • 1 5G cell 50MHz 2x2 • 3 cells 20MHz 2x2 • 3 cells 40 MHz SISO 5G NR NSA Mode • 1 5G NR 50MHz 2x2 + 1 LTE 10MHz 2x2 • 1 cell 5G NR 40 MHz 2x2 + 1 cell LTE 20 MHz 2x2 • 1 cell 5G NR 40 MHz SISO + 2 cells LTE 20 MHz 2x2 NB-IOT • 3 NB-IoT standalone cells • 3 LTE cells with an in-band or guard-band NB-IoT cell each LTE-M • 3 LTE cells with CAT M1 support

Configuration Possibilities

Advanced	Ultimate
4G LTE • 4 cells 20 MHz 2x2 • 2 cells 20 MHz 4x4 5G NR SA Mode • 4 FR1 cells 100 MHz 2x2 • 2 FR1 cells 100 MHz 4x4 • 1 FR1 cell 100 MHz 4x4 + 1 FR2 cell 100 MHz 2x2 5G NR NSA Mode • 1 5G NR 100 MHz 4x4 + 1 LTE 20 MHz 4x4 • 2 FR1 cells 5G NR 100 MHz 2x2 + 2 cells LTE 20 MHz 2x2 • 1 FR2 cell 5G NR 100 MHz 2x2 + 1 cells LTE 20 MHz 4x4 NB-IOT • 4 NB-IoT standalone cells • 4 LTE cells with an in-band or guard-band NB-IoT cell each LTE-M • 4 LTE cells with CAT M1 support	4G LTE • 8 cells 20 MHz 2x2 • 4 cells 20 MHz 4x4 5G NR SA Mode • 8 FR1 cells 100 MHz 2x2 • 4 FR1 cells 100 MHz 4x4 • 2 FR1 cell 100 MHz 4x4 + 1 FR2 cell 100 MHz 2x2 5G NR NSA Mode • 3 5G NR 100 MHz 4x4 + 1 LTE 20 MHz 4x4 • 4 FR1 cells 5G NR 100 MHz 2x2 + 4 cells LTE 20 MHz 2x2 • 2 FR2 cell 5G NR 100 MHz 2x2 + 1 cells LTE 20 MHz 4x4 NB-IOT • 8 NB-IoT standalone cells • 8 LTE cells with an in-band or guard-band NB-IoT cell each LTE-M • 8 LTE cells with CAT M1 support

SDR Cards

Specification

	SDR 50	SDR 100
Dimensions H × W ×D	2 cm × 11.5 cm × 12.8 cm	2 cm × 13 cm × 22 cm
Weight	0.1 kg	0.2 kg
Frequency Range	500 MHz to 6.0 GHz	500 MHz to 6.0 GHz
RF Bandwidth	200 KHz to 56 MHz	1.4 MHz to 100 MHz
Power Supply Voltage	12 V DC input	12 V DC input
Operation Mode	FDD and TDD	FDD and TDD
MIMO	2x2	4x4
ADC/DAC Sample rate	61.44 MS/s	122.88 MS/s
ADC/DAC Resolution	12 bits	12 bits
Frequency Accuracy	2 ppm	< 1 ppm
PCIe Requirement	1x / Gen 2	8x / Gen 3
LTE 20 MHz 64QAM EVM	<4% RMS (f<3.5 GHz) <2% RMS (f<2.6 GHz)	<4% RMS (f<3.5 GHz) <2% RMS (f<2.6 GHz)
Synchronization	Internal clock , PPS signal, GPS , Reference External clock (LVDS)	Internal clock , PPS signal, GPS, Reference external clock (LVDS)

Unlock mmWave Performance

About the Package

The FR2 package expands the capabilities of the Network Emulator by enabling mmWave technology. This package includes:

- **Up-Down Converter (UDC):** Converts the sub6 signal from the 100 MHz SDR card to mmWave signals and vice versa.
- **RF Cables:** High-frequency cables for efficient signal transmission.
- **Horn Antennas:** Directional antennas optimized for mmWave frequencies.

Specification

Dimensions H × W ×D	4 cm × 9.5 cm × 27.5 cm
Weight	0.2 kg
Frequency Range	Two Variants - 24 to 30 GHz - 37 to 40 GHz
RF Bandwidth	1 GHz
Power Supply Voltage	12 V DC input

The FR2 package is an optional add-on for the Advanced and Ultimate models.

RAN Specification

Features	eNodeB	gNodeB
3GPP Release	LTE release 17	LTE release 17 - eMBB, RedCAP and NTN support
Frequency Bands	All FDD and TDD bands in sub-6GHz	All FDD and TDD bands in sub-6GHz + FR2 bands
Bandwidth	1.4, 3, 5, 10, 15 and 20 MHz in LTE	Up to 100 MHz in LTE
	200 KHz for NB-IoT supporting all operation modes (in-band, guard band and standalone).	Multi BWP support.
Subcarrier Spacing	Not Applicable	Data: 15, 30, 60 or 120 KHz
		SSB: 15, 30, 120 or 240 KHz
Number of active UEs	Up to 1000 UEs	Up to 1000
Carrier Aggregation	Up to 8 carriers in DL and 3 in UL allowing mixed FDD/TDD combinations in DL	Up to 8 carriers in DL and 3 in UL allowing mixed FDD/TDD combinations in DL
Transmission Modes or MIMO	1 (single antenna) to 10 (MIMO 4x4)	Up to MIMO 4x4 in UL and DL
Modulation Schemes	Up to 1024QAM in DL and 256QAM in UL	Up to 1024QAM in DL and 256QAM in UL
Encryption and integrity protection	AES, SNOW3G, ZUC	AES, SNOW3G, ZUC

RAN Specification - continued

Features	eNodeB	gNodeB
Handover	Intra eNodeB, S1, X2 , Intra ng-eNodeB, NG, Xn and EPS to 5GS handover support	Intra eNodeB, S1, X2 , Intra ng-eNodeB, NG, Xn and EPS to 5GS handover support
eNodeB network interfaces	S1AP and GTP-U to EPC X2AP between eNodeBs M1 and M2 for eMBMS	S1AP and GTP-U to EPC X2AP between eNodeBs M1 and M2 for eMBMS
ng-eNodeB network interfaces	NGAP and GTP-U to 5GC XnAP between ng-eNodeBs	NGAP and GTP-U to 5GC XnAP between ng-eNodeBs
Other Capabilities	LTE/LTE-M • Rel 16 compliant • LTE category 0 and 1 • LTE-M cat M1 FDD, HD-FDD and TDD support • Group WUS support NB-IOT • Rel 17 compliant • NTN support • NB-IoT single-tone and multi-tone cat NB1 and NB2 • 15 kHz and 3.75 kHz subcarrier spacing • Support of two HARQ processes. • Group WUS support • CP CIoT optimization	Supported Modes: SA and NSA NR Split Bearer: 3, 3a and 3x

Core Specification

Features	EPC	5GC
3GPP Release	LTE release 17	NR release 17
Network Functions	Mobility Management Entity (MME), Serving Gateway (SGW), Packet Data Network Gateway (PGW), Home Subscriber Server (HSS), Policy and Charging Rules Function (PCRF) and Equipment Identity Register (EIR) all integrated within the same software component	Access and Mobility Management Function (AMF), Authentication Server Function (AUSF), Session Management Function (SMF), User plane Function (UPF), UDM (Unified Data Management) and 5G-EIR (5G Equipment Identity Register) all integrated within the same software component
NAS Encryption and integrity protection	AES, SNOW3G, ZUC	AES, SNOW3G, ZUC
USIM Authentication	XOR, Milenage, TUAK	XOR, Milenage, TUAK , ECIES profile A and B, 5G AKA, EAP AKA Prime , EAP TLS
PDN or PDU Type	IPv4, IPv4v6, IPv6 and non-IP and Ethernet	IPv4, IPv4v6, IPv6 and non-IP and Ethernet
QoS	Support of all LTE QCIs as well TFT and dedicated bearers	Support of all NR 5QIs as well TFT and dedicated bearers. Network Slicing

Core Specification - continued

Features	EPC	5GC
Network Interfaces	S1AP and GTP-U to multiple eNodeBs	NG interface (NGAP and GTP-U protocols) to multiple gNodeBs, ng-eNodeBs
	Rx to external IMS server, S6a to external HSS	Rx and N5 interface to external IMS server, N12 to external AUSF, N8 and N13 to external UDM
	S13 to external EIR, SGsAP to external VLR/MSC	N17 to external 5G-EIR, N20 to external SMSF
	SBcAP to external CBC and LCS-AP to external E-SMLC	N50 to external CBC, NL1 interface to External LMF
Handover	Intra-MME and EPS 5GS IRAT handover support	intra-AMF and 5GS EPS IRAT support
RAT	LTE, NB-IoT, NR (Support of DCNR UEs)	NR, LTE, NB-IoT
IoT Features	- control plane CIoT EPS optimization - Non-IP data delivery CIoT feature - Attach without PDN connectivity - Group WUS support - NTN NB-IoT Rel17	- CIoT 5GS optimization - Non-IP data delivery CIoT feature - RedCap support
Power saving features	PSM and eDRX	MICO, active time and eDRX

IMS Core Specification

Network Elements	S1AP and GTP-U to multiple eNodeBs Rx to external IMS server, S6a to external HSS S13 to external EIR, SGsAP to external VLR/MSC SBcAP to external CBC and LCS-AP to external E-SMLC
USIM Authentication	XOR, Milenage, TUAK , ECIES profile A and B, 5G AKA, EAP AKA Prime , EAP TLS
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 Version	IPv4, IPv4v6, IPv6
Services	• Voice call, • Video call • Voice echo test • Call hold • SMS over SIP and SMS over SG

eMBMS Gateway Specification

Network Elements	LTE eMBMS Gateway (eMBMSGW) Multi cell Coordination Entity (MCE)
Network interfaces	• M1 interface to eNodeB for user plane • M2AP interface to eNodeB for control plane

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Thank You