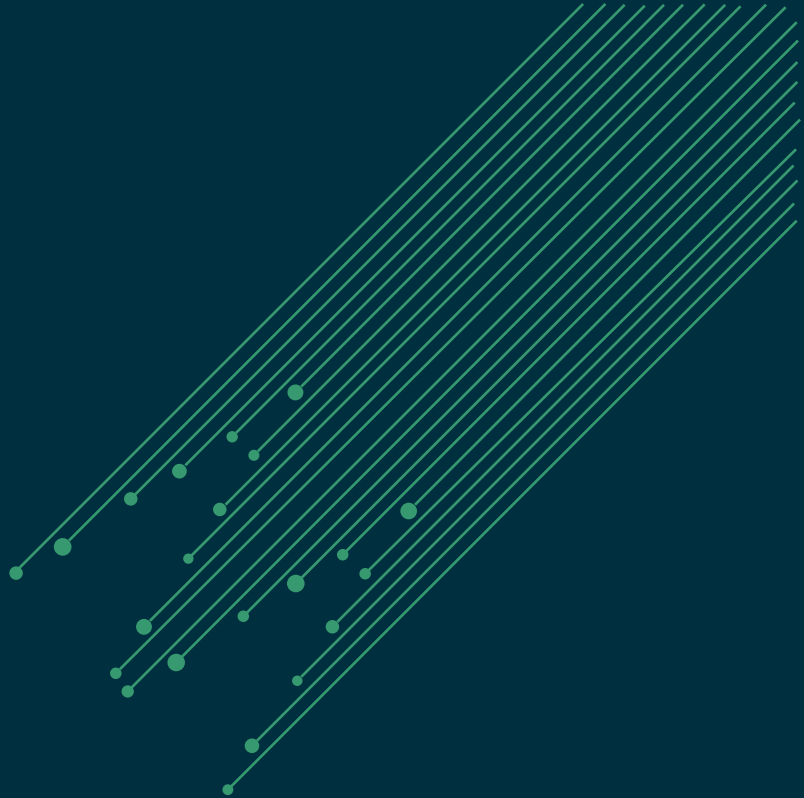




**SIMNOVUS**



# **NETWORK EMULATOR**

**Data Sheet**

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# OVERVIEW

## Validate 4G/5G UE Functionality

The Simnovus Network Emulator is your plug-and-play solution for LTE and NR testing of all types of user equipment with advanced configuration.

It acts as a 3GPP compliant eNodeB, ng-eNodeB, gNodeB, EPC and 5GC allowing for functional and performance testing of NR, LTE, LTE-A, LTE-M and NB-IoT devices. The offer is completed by an integrated IMS server as well as an eMBMS gateway for VoLTE/VoNR and eMBMs testing.

The Network Emulator is powered by a deployment-quality LTE and NR software suite offering the same level of baseband functionality as an indoor/outdoor network.

## Simplify Testing and Get to Market Faster

Significantly reduce 5G/4G UE validation time with our plug-and-play Simnovus Network Emulator 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 Network Emulator 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.

## Multiple Solution Options for UE Throughput Requirements

Simnovus provides several Network Emulator options to fulfill specific user’s requirements for UE category and UE throughput. All solutions run on the same COTS hardware and share the same software base

Choose an option based on your current test needs and upgrade/downgrade as needed with a license switch on the same COTS platform and the required number of SDR cards for the solution option.

Network Emulator Mini	Network Emulator Classic	Network Emulator Advanced
Ideal for NB-IoT, CAT-M1, CAT0 to CAT4 UE testing	Supports 4x4 MIMO, carrier aggregation and multiple cells configuration. Ideal for testing up to CAT10 LTE UEs	Supports 1 NR cell 100 MHz 4x4 and 1 LTE cell 20MHz 4x4 in sub 6GHz bands. With FR2 package, supports 2 cells 100MHz 2x2 in mmWave bands. Ideal for testing NR and LTE UEs

*Refer to the Specifications section for details on the three Network Emulator options offered by Simnovus.*

# FEATURE SUMMARY

<b>Runs on COTS</b>	Simulates eNB, gNB, EPC, 5GC, eMBMS and IMS core on the same x86 platform
<b>Channel Modeling</b>	Emulates different DL channel types as per 3GPP models defined in 36.101 and 38.141 specifications
<b>Frequency Agnostic</b>	Supports all FDD/TDD frequency bands including non-standard for custom sub-6GHz and mmWave frequency testing
<b>Supports Negative Testing</b>	Provides ability to override the nominal protocol behavior to simulate error cases
<b>High Performance</b>	Supports high LTE and NR data rates up to 5 Gbps downlink and 500 Mbps uplink
<b>Advanced Troubleshooting</b>	Provides multi-layer logging and multi-level statistics with correlation
<b>Enables Automation</b>	Provides extensive WebSocket APIs to instrument simulated network components and automate tests

# SPECIFICATIONS

## eNodeB

	Mini	Classic	Advanced
3GPP release	LTE release 16		
Frequency bands	All FDD and TDD bands in sub-6GHz		
Bandwidth	1.4, 3, 5, 10, 15 and 20 MHz in LTE. 200 KHz for NB-IoT supporting all operation modes (in-band, guard band and standalone).		
Supported number of UEs	Up to 500 UEs distributed within the configured cells	Up to 1000 UEs distributed within the configured cells	
Supported number of Cells	1	Multiple	
Carrier aggregation	Up to 3 carriers in DL and 3 in UL allows mixed FDD/TDD combinations in DL		Up to 4 carriers in DL and 3 in UL allows mixed FDD/TDD combinations in DL
Transmission modes	1 (single antenna) and 2 to 10 (MIMO 2x2)	1 (single antenna) and 2 to 10 (MIMO 4x4)	
Modulation schemes	Up to 1024QAM in DL and 256QAM in UL		
AS encryption and integrity protection	AES, SNOW3G, ZUC		
Handover	S1 and X2, NG, Xn and EPS to 5GS handover support	Intra eNodeB, S1, X2 , Intra ng-eNodeB, NG, Xn and EPS to 5GS handover support	
IoT	TE category 0 and 1 LTE-M cat M1 FDD, HD-FDD and TDD support NB-IoT single-tone and multi-tone cat NB1 and NB2		
NB-IoT subcarrier spacing	15 kHz and 3.75 kHz		
Network interfaces	S1AP and GTP-U to EPC, X2AP between eNodeBs, M1 and M2 for eMBMS		

## gNodeB

	Mini	Classic	Advanced
3GPP release	Release 16		
Frequency bands	FDD/TDD FR1 (< 6 GHz)		FDD/TDD FR1 (< 6 Ghz) and FR2 *
Bandwidth	Up to 20 MHz	Up to 50 MHz	Up to 100 MHz
MIMO	Up to MIMO 2x2 in DL	Up to MIMO 4x4 in DL	Up to MIMO 4x4 in DL and UL
Subcarrier spacing	Data subcarrier spacing: 15, 30, 60 or 120 kHz SSB subcarrier spacing: 15, 30, 120 or 240 KHz		
Modulation schemes	Up to 256QAM in DL and 64QAM in UL	Up to 256QAM in DL and 256QAM in UL	
Supported modes	SA	NSA, SA	
NR Split Bearer	N/A	3, 3a and 3x	
Use case	eMBB		
Network interfaces	NG interface (NGAP and GTP-U) to 5GC XnAP between gNodeBs	NG interface (NGAP and GTP-U) to 5GC	NG interface (NGAP and GTP-U) to 5GC XnAP between gNodeBs
Carrier Aggregation	N/A	Up to 3 DL carriers in SA and NSA	Up to 3 DL carriers in SA and NSA
Handover	NG, Xn and 5GS to EPS handover support	Intra gNodeB, NG, Xn and 5GS to EPS handover support	

## Supported number of cells

	Mini	Classic	Advanced
Max number of LTE cells	1	3	4
Max number of 5G cells	1	3	4
Max total number of cells	1	3	4
$\Sigma (B_i * L_i)$	40	120	800

$B_i$  is the bandwidth in MHz of cell  $i$ ,  $L_i$  is the number of dl MIMO layer for cell  $i$

## Configuration examples

	Mini	Classic	Advanced
LTE Only	20MHz 2*2	3CC 20MHz 2x2, 1CC 20MHz 4x4	4CC 20MHz 2x2, 2CC 20MHz 4x4
5G	SA: 1 5G cell 20MHz 2x2	NSA: 1 5G NR 50MHz 2x2 + 1 LTE 10MHz 2x2 SA: 1 5G cell 50MHz 2x2 or 3 cells 20MHz 2x2	NSA – either of these configurations: <ul style="list-style-type: none"> <li>• 1 5G NR TDD 100MHz 4x4 FR1 + 1 LTE 20MHz 4x4</li> <li>• 1 5G NR TDD 100MHz 2x2 FR2* + 1 LTE 20MHz 4x4</li> <li>• 1 5G NR FDD 50 MHz 4x4 + 1 LTE 20MHz 4x4</li> </ul> SA: <ul style="list-style-type: none"> <li>• 2 5G NR TDD 100MHz 4x4 or 2 5G NR FDD 50 MHz 4x4</li> </ul>
NB-IoT	1 NB-IoT cell in standalone, in-band or guard-band model	3 NB-IoT standalone cells, 3 LTE cells with 1 in-band or guard-band NB-IoT cell	4 NB-IoT standalone cells, 4 LTE cells with 4 in-band or guard-band NB-IoT cells
LTE-M	1 LTE cells with CAT M1 support	3 LTE cells with CAT M1 support	4 LTE cells with CAT M1 support

## EPC

	Mini	Classic	Advanced
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 QCI 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		
CloT features	Control plane CloT optimization, Non IP data delivery, Attach without PDN connectivity		
Power saving features	PSM and extended DRX		

## IMS Core

	Mini	Classic	Advanced
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		

## eMBMS Gateway

	Mini	Classic	Advanced
Network Elements	LTE eMBMS Gateway (eMBMS-GW) and Multi-cell Coordination Entity (MCU)		
Network interfaces	M1 interface to eNodeB for user plane M2AP interface to eNodeB for control plane		

## 5G core

	Mini	Classic	Advanced
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		

\* FR2 support requires FR2 Package in addition to the Simnovus Network Emulator Advanced

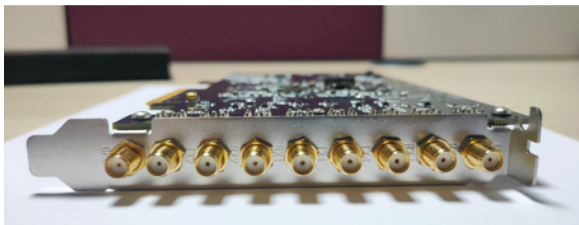
# HARDWARE REQUIREMENTS

The Simnovus Network Emulator runs on COTS hardware and comprises the following components:

**Network Emulator\*:** Simnovus currently ships the server pictured. The server can house one or two SDR cards.



*Network Emulator 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

Network Emulator (Provided by Simnovus)
COTS hardware
CPU: Intel i9
Clock speed: Max turbo frequency 460GHz
Number of cores: 18
RAM: 4 x 8GB DDR4
OS: Ubuntu 20.04
Disk space: 1TB
NIC ports: dual Intel 2.5G Ethernet
PCIe Gen 3 slots: 7

# ORDERING INFORMATION

The Simnovus flexible all-inclusive licensing provides simplified ordering:

## Step 1:

Select Network Emulator type (Mini, Classic, or Advanced) for software license

## Step 2:

Select number of SDR cards

## Step 3 (Optional):

Select FR2 package (with Advanced) for software license

Get started today!

Contact **[sales@simnovus.com](mailto:sales@simnovus.com)**.

*This information is subject to change without notice.*

