CoreSIM: RAN Core Emulation Solution for Wrap-Around gNodeB/eNodeB Testing

Make Radio Access Network Testing Easier

A 4G/5G core simulator, CoreSIM makes Radio Access Network testing easier by eliminating Core Network unwanted dependencies and allowing an easily controllable, repeatable test environment setup. RAN test efforts can thus be concentrated on the Device Under Test, speeding up 3GPP standards implementation.

Highly scalable, CoreSIM allows up to hundred independent test lines in parallel. An EPC simulator is available for NSA (option 3x) wrap-around and a 5G Core simulator for SA wrap-around. Data, voice, video protocols are supported.

This virtual solution can be hosted on any Intel based server, or on proven Keysight optional hardware.

Full automation via Tcl, Python, and REST APIs is available, allowing users to create regressions for continuous validation of product quality.

Scalable Virtual Solution for 4G/5G Core

- 5G Core simulator for SA wrap-around
- EPC simulator for LTE and 5G NSA wrap-around
- Virtual solution (Keysight hardware optionally available)
- Highly scalable to hundreds of independent test lines
- Up to tens of thousands of UEs per instance
- Up to 1000 procedures/sec per instance
- 10 Gbps throughput (DL+UL) per instance
- 3 Gbps (UL+DL) throughput with IP Passthrough feature
**5G NSA (Option 3x) and LTE RAN Validation**

In the non-standalone (NSA) network topology, or in case of LTE only RAN, the CoreSIM simulates MME, SGW and PGW components over S1 interface.

It can be employed as a standalone tool or in combination with Keysight UeSIM, RuSIM or DuSIM emulators, for a complete wrap-around testing of LTE eNodeB, 5G gNodeB or O-RAN O-DU and O-CU components.

![Diagram of EPC emulation for LTE and 5G NSA option 3x](image)

Figure 1. EPC emulation for LTE and 5G NSA option 3x.

**5G SA RAN Validation**

In the 5G standalone (SA) topology, the CoreSIM simulates control plane traffic from the AMF over the N1 and N2 interfaces, and user plane traffic from the UPF over the N3 interface towards the NG-RAN.

![Diagram of 5G Core emulation for 5G SA option](image)

Figure 2. 5G Core emulation for 5G SA option.
One User Interface for the Different RAN Testing Needs

The CoreSIM user interface is common across different products of the Keysight O-RAN testing portfolio, enabling a seamless user experience.

![EPC topology configuration interface](image3.png)  ![5G Core topology configuration interface](image4.png)

Figure 3. EPC topology configuration interface.  Figure 4. 5G Core topology configuration interface.

Quality of Experience Metrics

User has access to hundreds of comprehensive statistics in real-time during test execution with user-configurable views. All statistics are also available after the test in CSV format for post-processing.

![Runtime Statistic Viewer](image5.png)

Figure 5. Runtime Statistic Viewer.

Software Only Test Solution with optional Hardware

CoreSIM virtual components are software optimized for stateful protocol emulation in virtual environments, adapting to your infrastructure and easily scaling to follow your testing needs.

Comprehensive platform support including standalone hypervisors (VMware ESXi and KVM) and OpenStack-based private clouds.

Optional Keysight hardware available.
Product Capabilities

5GC Control Plane

- Simulation of AMF and UPF over N1, N2, N3 interfaces
- NR Registration/Deregistration procedures
- gNB to gNB handover procedures
- Multiple Data Network Names (DNN)
- Multiple associated QoS Flows
- Multiple PDU sessions
- Support for IPv4 and IPv6 transport and PDN connections
- Support of EPS Fallback

EPC Control Plane

- Simulations of MME, SGW and PGW components over S1 interface
- Dual Connectivity Radio Connection Support
- Support for Network Slicing with dedicated core network (DCN) for UE Range
- Support of IDLE state, Paging and TAU procedures
- Support for IPv4 and IPv6 transport connections
- Support for IPv4, IPv6, and IPv4v6 (dual stack) PDN connections
- S1 and X2 based handovers, including MME and MME/SGW relocation options
- Support for Trace Procedures activated during or after Attach.
- Option to configure authentication modes for UE ranges
- Configuration of DSCP marking at S1, and configurable DSCP marking for each GTP tunnel per its QCI value.
- P-CSCF Discovery Support
- Support for Home eNodeB and Small Cell testing
- eDRX and PSM support
- User-Configurable Procedural Failure Testing at S1-NAS and S1-AP protocols level, including S1 setup failure, Handover procedure failures/timeout, Authentication and Security mismatch, NAS procedures retransmissions/timeout/rejects, TAU procedures mismatches

User Plane

- Configure multiple activities over the emulated networks
- Validate multiple access point names (APNs) and data network names (DNNs); Configuration of QoS and traffic flow template (TFT) per L7 activity
- Configure IP passthrough to include external traffic servers over N6 and SGi interfaces

Home eNB Gateway EPC

Test your Home eNodeBs, secured by Security Gateways (SeGWs) and IPsec. In this test topology, the simulator provides:

- IPsec-secured tunnels
- Digital certificates used during test
- Security Gateways (SeGWs)
- Evolved Packet Core

Run wireless traffic running over secure tunnels from a Home eNodeB Gateway and a Secure Gateway towards the system under test (Home eNodeB).

Supported authentication methods for IPSEC include Pre-Shared Key, EAP (MD5, AKA, SIM), EAP-TLS, and Certificates.
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Optional Hardware

**X100-5G**
- 2U appliance
- 2x CPU (Intel ES-2699V4, 22C, 2.4Ghz, 55Mb Cache)
- 128 GB RAM (2400-DDR4)
- 480 GB SSD
- Runs Ubuntu OS
- 4 PCI Express Slots

**25GE NIC**
- Dual SPF28 connectors
- Low-profile, short length standard form factor
- PCI-E 3.0 x8
- Mellanox ConnectX®-4 Lx EN Ethernet Controller
- Asset management features with thermal sensor
- Hardware offloads for VXLAN, NVGRE, and GENEVE encapsulated traffic
- Low-latency RDMA over converged Ethernet (RoCE)
- PCI-SIG SR-IOV compliant
- Jumbo frames support up to 9.6KB
- PXE support
- Erasure coding offload
- NC-SI for IPMI support
- RoHS compliant 6/6

**10GE NIC**
- Dual SFP+ connectors
- Low-profile standard form factor
- PCI Express 2.0 (up to 5GT/s)
- Intel® QuickData technology
- VMDq, next-generation VMDq, and PC-SIG SR-IOV for virtualized environments
- Load balancing on multiple CPUs
- iSCSI remote boot support
- FCoE
- Support for most network operating systems (NOSs)
- Support both DAC twin axial and LC fiber-optic SR cables
- RoHS compliant 6/6
Ordering Information

P88685A - Core Network Emulator over S1/N1/N2/N3 & L4-L7 Traffic Termination
Includes: Support S1 Interface for NSA option; N1/N2/N3 interfaces for SA option; Support up to 50 gNBs/eNBs; Up to 16K UEs, Throughput enabled up to 10 Gbps (total UL+DL); L4-7 Appl. Traffic Termination.

P8800P1 - LoadRAN - L4-L7 Traffic Generation & CoreSIM Lite
Includes LoadRAN L4-L7 Traffic Generation and CoreSIM Lite (limited to 8 gNBs/eNBs), supporting gNodeB wrap-around functional test in both NSA/SA topologies, with Core Network Emulation over S1/N1/N2/N3 and L4-L7 Traffic Generator/Termination.

P8800P3 - DuSIM and CoreSIM Lite
Includes DuSIM and CoreSIM Lite (limited to 8 gNB/eNB), supporting O-DU Emulation over F1 NSA/SA, Core Network Emulation over S1/N1/N2/N3 and L4-L7 Traffic Generator/Termination.

P88686A - CoreSIM Performance Enabler
Requires P88685A or any bundle including CoreSIM or CoreSIM Lite. Includes support for additional 50 gNBs/eNBs; additional 16K UEs; additional 10 Gbps Throughput (total UL+DL).

P8800H1-FG - X100 5G Appliance
Optional X100 5G Server (960-0529)

P8800H2-FG - 25GE NIC 2-ports
Optional 25GE NIC (960-0528)

P8800H3-FG - 10GE NIC 2-ports
Optional 10GE NIC (960-0999)

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