

DuSIM: O-DU Emulation Solution

For O-CU testing over F1 interface

Capturing the Promise of Dis-Aggregated 5G RAN

With the O-RAN dis-aggregated architecture, three distinct components emerge: the radio unit (O-RU), the distributed unit (O-DU), and the centralized unit (O-CU). O-RAN open interfaces facilitate multi-vendor network deployments, enabling a more competitive supplier ecosystem, thus introducing a strong demand for conformance, interoperability, and performance testing for all these components.

Keysight helps network equipment manufacturers, as well as mobile operators, in simplifying the interoperability challenges among multiple vendors to test the split architecture.

DuSIM is a O-DU emulator to validate O-RAN O-CU functionality, performance, and conformance over the Higher-Layer Split midhaul interface (F1 interface).

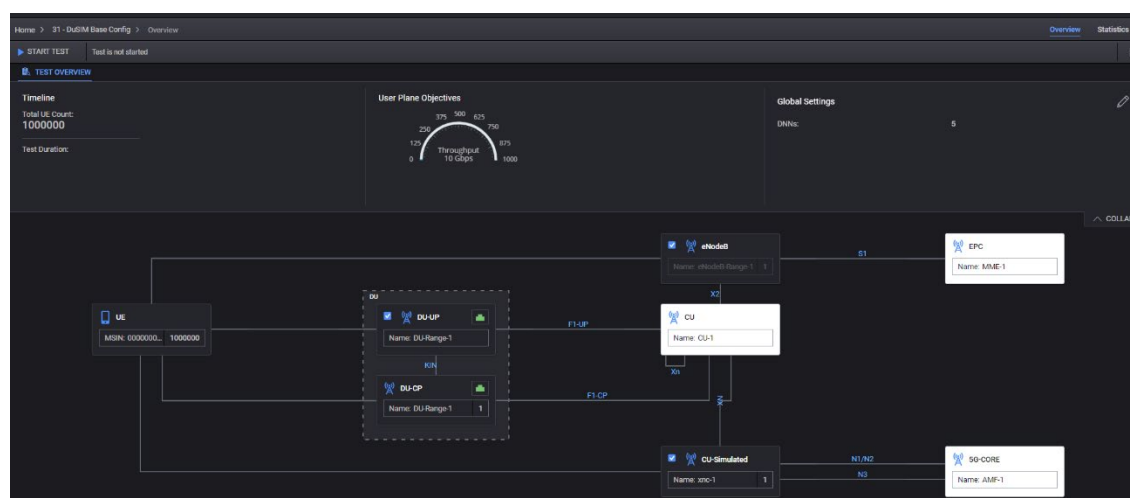


Figure 1. O-DU Emulator graphical user interface

DuSIM Overview

Highly scalable, DuSIM can emulate hundreds of O-DUs and is targeted at O-CU vendors who want to test the scalability of their architectures. This virtual solution (with Keysight specialized hardware optionally available) supports the Control Plane/User Plane (CP/UP) split and both Non-Standalone (NSA) and Standalone (SA) topologies. DuSIM can include a real 5G or 4G Core in the system under test, or O-CU wrap-around testing is also possible using CoreSIM, Keysight's core emulation product. Simulated eNBs and simulated O-CUs can also be added to the tests, exposing X2 and Xn interfaces respectively.

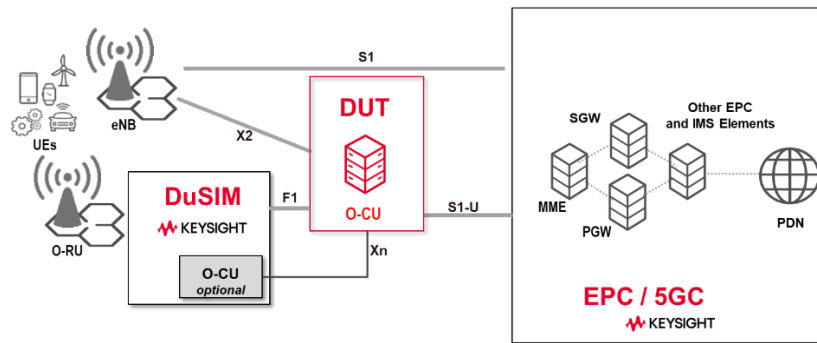


Figure 2. DuSIM usage in wrap-around test topology

DuSIM supports full automation via REST APIs, allowing users to create regression test plans for continuous validation of product quality.

Key benefits

- Wraparound O-CU testing with support for RRC and NAS features, subscriber behaviors, and complex application traffic flows
- Runs in lightweight VM on standard COTS hardware, or as container in public/private cloud.
- Performance, Capacity Testing with Cloud Native platform that supports vertical and horizontal scaling to achieve control and user plane test objectives.
- Support for co-existence of Non-Standalone and Standalone topologies under test, with EN-DC and NR-DC UE emulation options
- Optional Core Network emulation provides Inter-working Model Core for simultaneous Option 3X and Option 2 RAN test support.

Product Capabilities

Control Plane

- Support of Non-Standalone (NSA) and Standalone (SA) configuration procedures
 - MeNB and SgNB procedures over X2AP
 - eNB S1AP procedures
- GNB XnAP non-UE and UE procedures over XnAP
- IPsec support for Control Plane F1-C, S1-C and X2-C
- Negative testing scenarios using Impairment capability on F1 interface or force O-CU PDCP congestion via buffer control.
- DU failure scenario supported (user configurable DU on-off operation)
- Simulation of thousands of sessions across multiple coordinated emulated O-Dus
- UE signaling procedures: Register, Deregister, Authentication, Session Establishment and Release
- Validation of PDU Sessions establishment, uplink and downlink flows, deletion, and modification
- Cell changes, intra- and inter-DU handovers, and inter-CU handovers with real CUs under test or simulated neighbor CUs
- Option to configure single or multiple PDU sessions per UE, with single or multiple DNNs
- Test any mix of IPv4 and IPv6 for control and user planes.
- Ability to configure and execute control-plane-only traffic models
- Topology-driven user interface
- F1 / X2 / Xn / S1 / RRC / NAS statistics
- Message capture on control plane interfaces (F1-C / Xn-C / X2-C / S1-C / N1 / N2)

User Plane

- Activity support for HTTP, HTTPS, Stateless UDP, FTP (embedded or external FTP server), VoNR-IPME/MSRP, Video OTT HLS Flows, QUIC, HTTP/3, and more
- Multiple activities per UE, with distinct Layer 7 (L7) protocol and data rate profile; Mapping of multiple L7 activities to distinct UE ranges, with individual traffic profile and mix
- Validation of multiple access point names (APNs) and data network names (DNNs)
- Configuration of QoS and traffic flow template (TFT) per L7 activity, with pre-built and editable TFTs
- Reflective QoS support.
- Distinct objective configuration for each L7 activity: Simulated users, Throughput, Connections/second, Connection Attempts/second, and Concurrent connections
- Ciphering/Deciphering and Integrity protection/verification (NEA0 Null, 128-NEA1 Snow, 128-NEA2 AES, 128-NEA3 ZUC)
- IPSec support for User Plane, F1-U

- Jumbo frame support
- User-defined changes can be configured to outbound traffic with a programmatic interface.
- Drill down on TCP statistics per traffic objective
- Per UE user plane traffic adjustment, at run time (NR-U modification support)
- Message capture on user plane interfaces (F1-U / Xn-U / X2-U / S1-U / N3)

Keysight Open RAN Simulators Cloud Edition

DuSIM runs on top of the Keysight Open RAN Simulators infrastructure, a cloud-native platform which allows multiple Keysight products to run in parallel (CuSIM, DuSIM, CoreSIM and LoadCore). This test solution provides seamless integration on the same infrastructure as the Device Under Test (DUT), sharing the same look-and-feel and functionalities across all products. The Keysight Open RAN Simulators platform can accommodate any type of cloud – public or private – via the deployment of containers or complete Virtual Machines (VMs).

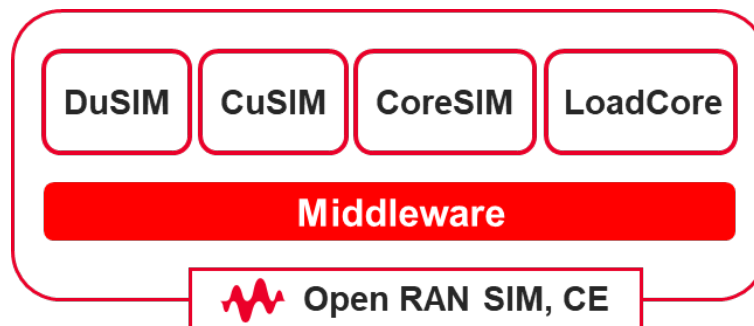
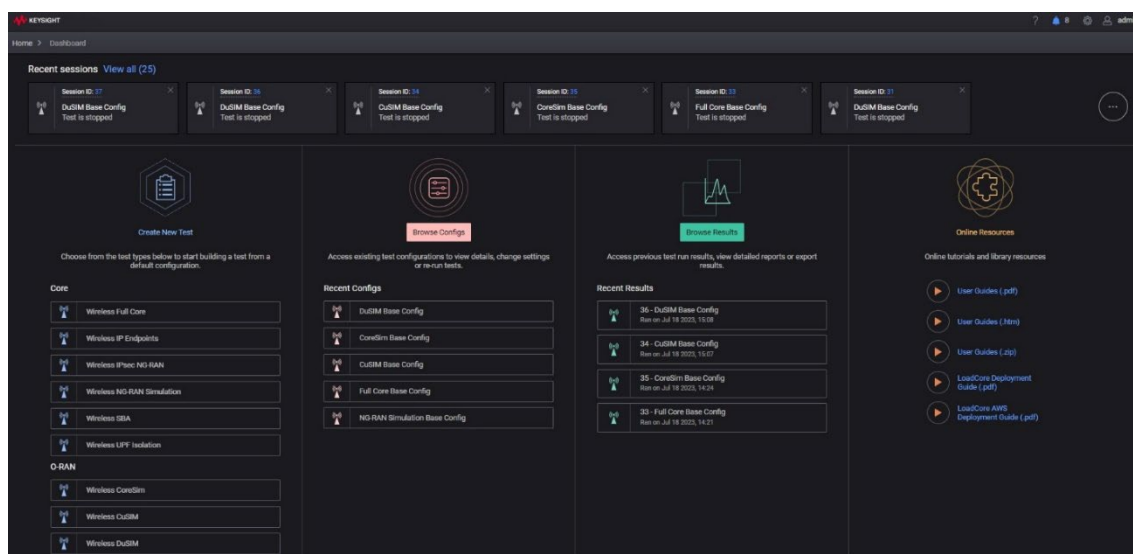


Figure 3. Keysight Open RAM Simulators Cloud Edition

One User Interface for the different O-RAN and Core testing needs

The Keysight Open RAN Simulators user interface is common across the different products of the Keysight O-RAN testing portfolio, both virtual and hardware-based, enabling end-to-end testing from a single common user interface.



Software-Only Solution with Optional Hardware

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

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

Specialized Keysight hardware is available on demand.

Model	Description
P88109H 	ORAN Server, runs Ubuntu OS • 56c Xeon 6238R processor • 128 GB RAM (3200MHz) • 2 x HDD: 4TB + 2TB • 2 x Power Supply
Network Interface Cards	Network Interface Cards • 4 x 10GbE X710 T4 • 2 x 100GBE-SFP MCX516A-CCAT • 2 x 10GBE-SFP Intel 520 • 2 x 25 GBE Intel XXV710 • 2 x 10GBE-SFP Intel 520
Size and weight	• Size: 43.7 cm width (19" rack mounted) 8.89 cm height (2U rack mounted) 45 cm depth • Weight: 14 Kg.



Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.

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