Landslide O-RAN O-CU Test Solution

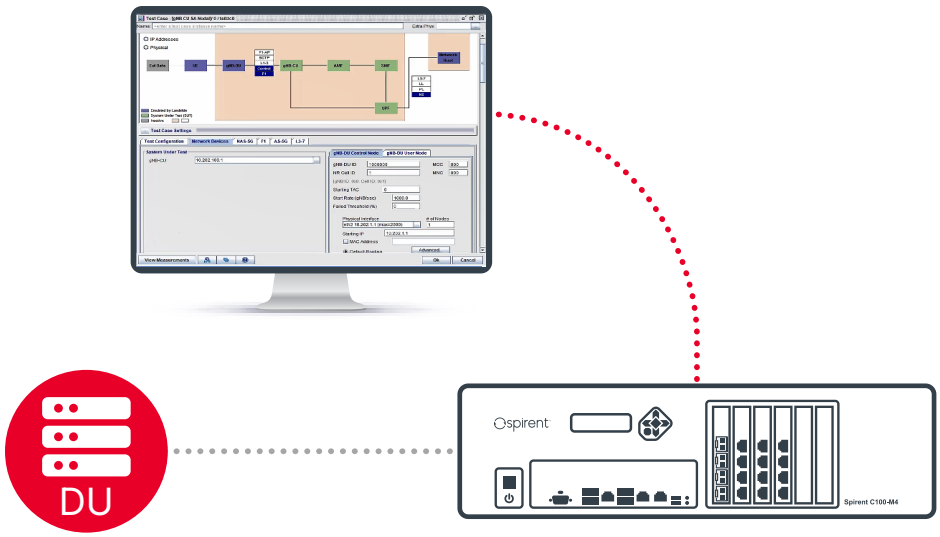
O-CU Wraparound Performance Testing

Introduction

The Landslide O-RAN O-CU Test Solution provides flexibility, scalability, and high performance for comprehensively testing the Centralized Unit (CU) for compliance, functionality, performance, and capacity.

The CU can be tested in isolation, in wraparound testing mode. the figure below, the O-CU test solution emulates all the network functions surrounding the CU, including Distributed Units (DUs) and user equipment (UEs), core network, eNBs/gNBs, neighboring CUs, and the RAN Intelligent Controller (RIC).

The core network emulation can be 5GC for Standalone (SA) mode, or it could be the evolved packet core (EPC) for Non-Standalone (NSA) mode. The CU can also be tested in an end-to-end configuration, in which case the core network is part of the system under test (SUT).



UE + O-DU Emulation
CU + Core Emulation
Automation
Security

KEYSIGHT

O-RAN Challenges

Open Radio Access Network (O-RAN) architecture disaggregates and splits traditional RAN into CU, DU, and Radio Unit (RU), supporting standardized open and interoperable interfaces and allowing key functions to run as virtualized software functions on vendor-neutral hardware. This avoids single-vendor dependency by opening the architecture to multiple suppliers.

However, lack of domain maturity, coupled with an increasing push for momentum, is creating a perfect storm when it comes to O-RAN. There are major challenges yet to overcome: ensuring performance and robustness, interoperability, new costs, security, and internal preparedness to deploy and manage O-RAN, just to name a few.

The CU sits between the DUs and the core network. The CU handles the higher layers of the protocol stack, where the critical packet processing functions typically reside (SDAP, RRC, and PDCP). A single CU handles many DUs. CUs are also virtualized and can be deployed on inexpensive, vendor-neutral commercial off-the-shelf (COTS) hardware. Cloud deployments are also an option, which brings its own set of challenges.

Disaggregated architecture, open interfaces, virtualization, multi-vendor interworking, and cloud deployments are some of the many challenges that mandate comprehensive testing of the CU.

Solution Overview

The single UI/UX is one of the most powerful features of Keysight's O-RAN O-CU Test Solution, allowing unified control for all the network functions in an easy and intuitive visual interface.

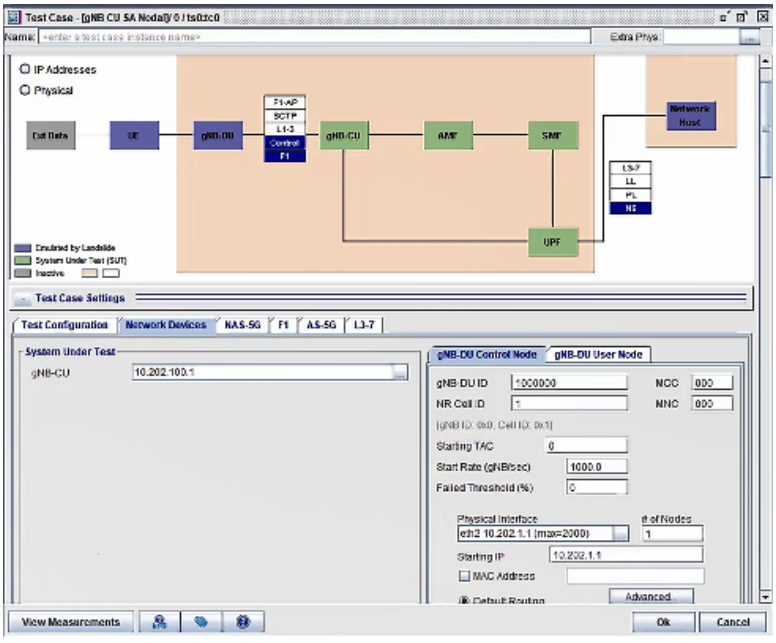


Figure 1. Software screenshot: Test case window

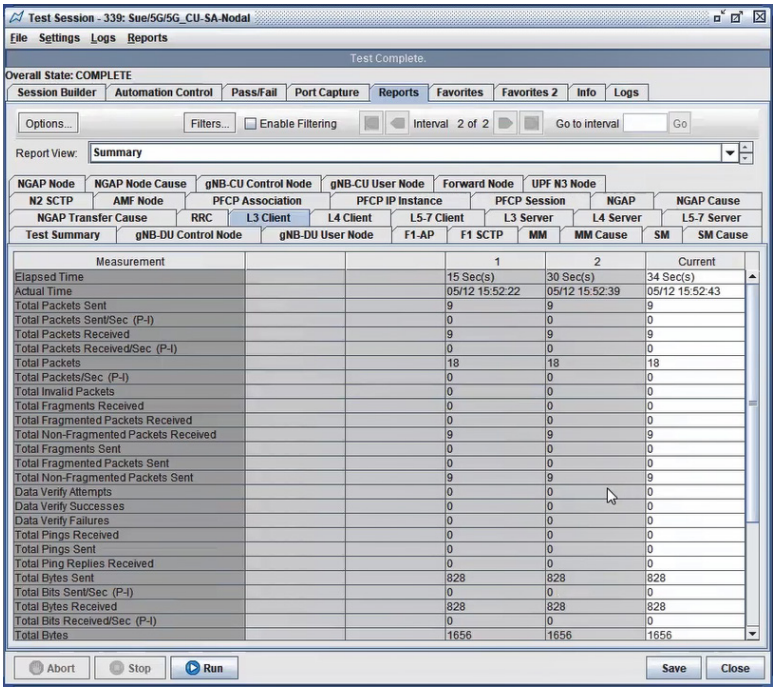


Figure 2. Software screenshot: Test report

Features

The O-CU Testing feature set includes the following capabilities:

- NSA and SA modes
- Emulation of UEs, DUs and 5GC, and/or EPC to completely surround the CU being tested
- Relevant interfaces F1-C, F1-U, N1, N2, N3, S1-U, S1-MME, X2, and Xn are supported
- Control plane and user plane testing
- Functional, performance, and capacity testing
- Support for intra-CU and inter-CU mobility scenarios
- High-performance solution that can be scaled to 1000s of emulated DUs, millions of emulated subscribers, 100s of Gbps of user plane traffic
- Call modeling capabilities to shape test traffic as needed, for control and user planes
- Highly customizable, with ability to edit messages onsite as needed
- Appliance-based or virtualized deployment options, including ability to deploy on public cloud platforms
- Automation through RESTful or Tcl API

Benefits

With the need to interoperate with network functions from different vendors, compliance to the specification is of paramount importance. Often, the same specification gets interpreted differently by different vendors. This can manifest itself in whether certain optional Information Elements (IE) are included or not in certain procedures.

Message editing capabilities empower users to quickly deal with these situations themselves. Powerful traffic modeling capabilities allow users to shape test traffic as needed, both for the control and user planes. This enables easy replication of live network traffic conditions, patterns, and scale in the lab.

Some of the key use cases that can be addressed include:

- DU, EPC, 5GC, eNBs, and gNB interoperability
- CU subscriber capacity
- CU DU capacity
- CU performance (e.g., registration rate)
- Single UE and aggregate data throughput capacity
- Real-world user plane traffic performance (such as HTTPS, QUIC, and application traffic such as Facebook, YouTube, Zoom, etc.)
- Voice and video quality
- Ability to handle real world mix and scale of events, including different types of mobility events
- CU robustness for handling abnormal, non-compliant messages and scenarios
- CI/CD automation pipeline integration

Technical Specifications

Keysight O-CU testing is compliant to release 15 of the following 3GPP specifications:

- 3GPP TS 24.301 Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3
- 3GPP TS 24.501 Non-Access- Stratum (NAS) protocol for 5G System (5GS); Stage 3
- 3GPP TS 29.281 General Packet Radio System (GPRS) Tunneling Protocol User Plane (GTPv1-U)
- 3GPP TS 36.331 Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC) protocol specification
- 3GPP TS 36.413 Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)
- 3GPP TS 36.423 Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 application protocol (X2AP)
- 3GPP TS 37.324 E-UTRA and NR; Service Data Adaptation Protocol (SDAP) specification
- 3GPP TS 37.340 NR; Multi-connectivity; overall description; Stage 2
- 3GPP TS 38.300 NR; NR and NG-RAN; overall description
- 3GPP TS 38.323 Packet Data Convergence Protocol (PDCP) specification
- 3GPP TS 38.331 Radio Resource Control (RRC) protocol specification
- 3GPP TS 38.401 NG-RAN; architecture description
- 3GPP TS 38.413 NG-RAN; NG Application Protocol (NGAP)
- 3GPP TS 38.415 NG-RAN; PDU session
- User Plane Protocol
- 3GPP TS 38.423 NG-RAN; Xn Application Protocol (XnAP)
- 3GPP TS 38.425 NG-RAN; NR User Plane Protocol
- 3GPP TS 38.473 NG-RAN; F1 Application Protocol (F1AP)

Table 1. Ordering Information

Description	Part number
Landslide RAN gNB-CU Test Application for 5G NSA Core (Option 3x) - Adds gNB CU testing to a Landslide C100 test system. Includes F1-C, F1-U, X2-C, X2-U RAN interfaces. Fingerprint of existing manager required	L-R-APP-080
Landslide RAN gNB-CU Test Application for 5G SA Core - Adds gNB CU testing to a Landslide C100 test system. Includes F1-C, F1-U, Xn-C, Xn-U RAN interfaces. Fingerprint of existing manager required	L-R-APP-082
Landslide 5G AMF Core Node Emulation Application - Adds 5G AMF core node or a combined AMF+SMF core node emulation to a Landslide C100 test system. Fingerprint of existing manager required	L-APP-053
Landslide 5G UPF Core Node Emulation Application - Adds 5G UPF core node emulation to a Landslide C100 test system. Fingerprint of existing manager required	L-APP-055
Landslide LTE Core Emulation - Emulates LTE MME, SGW and PDN-GW as one core unit. Provides S1-MME, S1-U, and SGi interfaces. Multiple interfaces included. TAS ID or fingerprint of LS test system required	L-FT-035

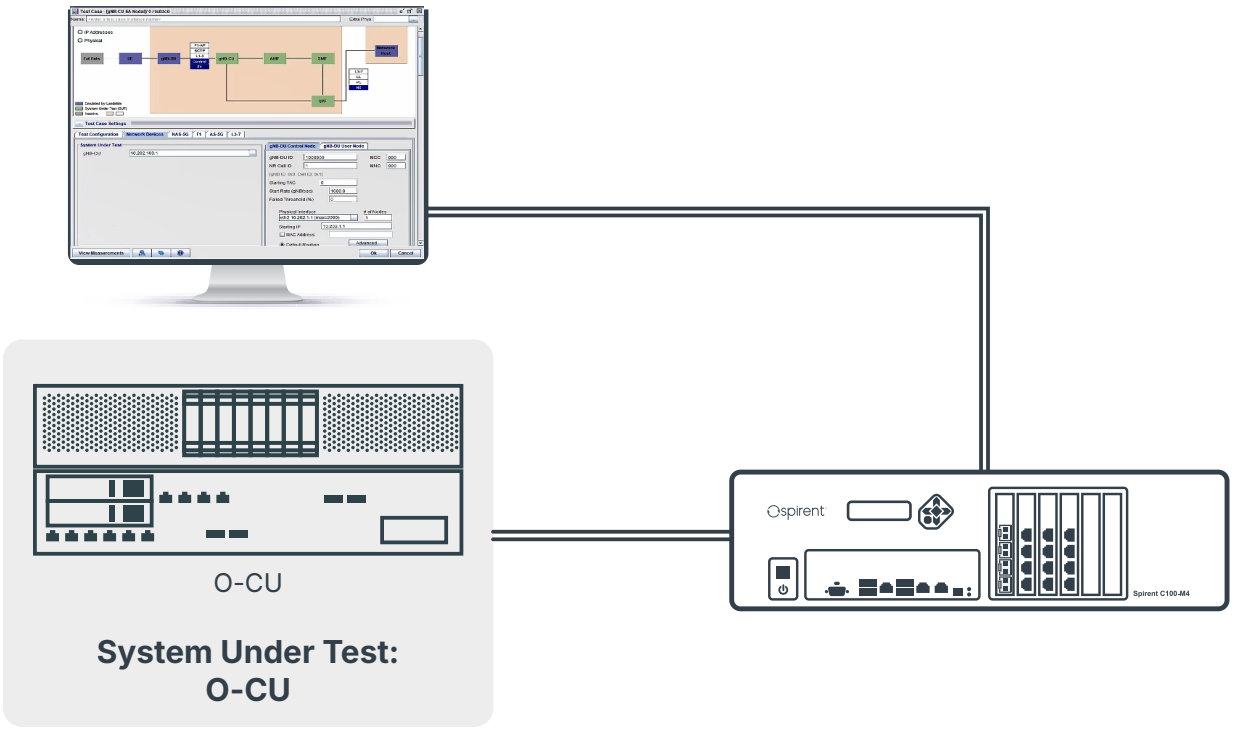


Figure 3. O-RAN O-CU Test Solution SUT diagram