

VIAVI

TeraVM

O-CU Test DU Sim

Overview

The TeraVM O-CU Test DU Sim provides a comprehensive validation test suite for the O-CU part of the disaggregated gNB.

The O-RAN Alliance is promoting the disaggregation of the gNB into three distinct, open and standardized elements:

- O-RU: Open Radio Unit responsible for digital front end, lower part PHY layers
- O-DU: Open Distributed Unit responsible for RLC, MA and higher part PHY layers
- O-CU: Open Central Unit responsible for RRC and PDCP layers

VIAVI is introducing a new O-RAN test suite to help vendors validate their products according to the O-RAN standards as well as Service Providers wishing to verify the interoperability of these components before launching their network.

The TeraVM O-CU Test DU Sim is a software-based test tool housed on x86 hardware - compliant against 3GPP F1 application protocol and capable of emulating up to 64 DUs, 40 million connection attempts per hour, 50+ Gbps of traffic in order to functionally and load test the O-CU. To increase flexibility and cover a wider set of customer use cases additional optional elements of the test suite are available, shown in Figure 1.

- 5G SA/NSA Core Emulator for use cases where a real Core Network is absent
- X2 CU Tester for 5G NSA test use cases
- Xn CU Tester for 5G SA test use cases

Features

- First to market O-CU wraparound test compliant with latest 3GPP, O-RAN standards
- Runs in lightweight VM on standard x86 hardware
- CI/CD Automation Integration
- Functional Testing
- Performance, Capacity Testing
- Supports Open source automation tools such as Jenkins
- Optional Core Emulator, Core Tester

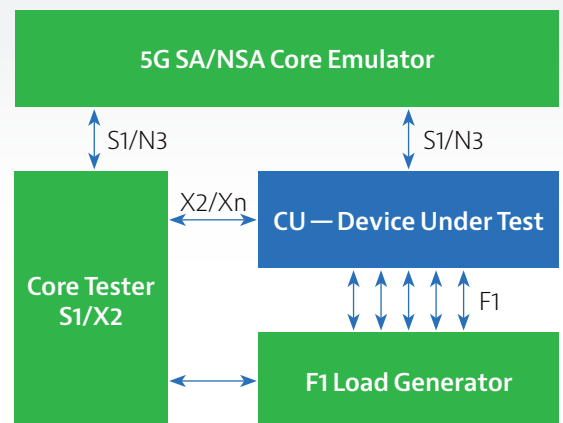


Figure 1

Preparing for the Challenges of O-RAN Fronthaul Testing

The cellular industry is adopting cloud and virtual network technologies to simplify deployment, maintenance and optimize capital expenditure. To support this, one of the key objectives of the O-RAN Alliance is to bring uniformity in connectivity and test interfaces, and foster the use of off-the-shelf hardware as a means of reducing costs. Achieving these objectives opens new challenges for Network Equipment Manufacturers and Operators in particular. Some of the challenges include:

- **Challenge of guaranteeing performance with scale and capacity** E.g. ensuring that the O-CU can cope with high data volume and multiple DUs.
- **Ensuring inter-operability with legacy Radio Access Technologies (RAT) such as 4/4.5G.** This is an important short/long term challenge for overall network performance management as 5G and O-RAN are expected to work with legacy. Operators and NEMs cannot ignore this as it can have a major impact on the Quality of Service (QoS) for 4G users in scenarios such as mobility and handover.
- **Operators may have to do their own tests** due to different vendor specific O-RAN requirements e.g. the O-DU and O-CU can be from different vendors. This adds complexity from software release management to getting the full network working end-to-end. Operators will need to decide whether to do the tests themselves or outsource testing to a lead vendor that can take responsibility for end to end system performance testing.
- **Limited UE test capability and vendor experience** If in-house solutions or a UE vendor with limited experience are used for testing, the breadth of 5G features and capabilities may be limited and may not have the sufficient coverage for a comprehensive test. This can put limitations on what can be tested or supported.
- **Coping with different O-RAN customer requirements** from an integration point of view can be problematic. Although O-RAN standards are meant to be universal, there is room for vendor specific requirements. For example the O-RAN M-plane management which is defined by radio parameters, transport settings, RU management and state changes.

Why VIAVI?

VIAVI has an end-to-end O-RAN product portfolio for multi-vendor RAN development, test and IoT. VIAVI is a one stop shop, simplifying the complexity of testing different O-RAN interfaces across the network. Customers can rely on an unparalleled global support footprint, reduced complexity of integration and coordinated support as part of the VIAVI Lab to Field and RANtoCore solutions.

Over many years of working with all major NEMs and small cell manufacturers, VIAVI has built a reputation as a trusted supplier of leading edge cellular test equipment. Our flexible approach and ability to accommodate different customer requirements allows to support the various options and configurations different operators require in order to deploy O-RAN solutions.

VIAVI is part of O-RAN and is involved in developing specifications. This is important particularly in supporting multiple vendors with different vendor specific requirements. As O-RAN continues to evolve, VIAVI is well placed to align with its objectives on virtualization, interoperability and the use of low cost, off-the-shelf platforms.

O-CU Test Cases

Simultaneously emulate large number of DU nodes at F1 interface to CU. Deliver realistic traffic from large number of UEs. NSA test scenarios are supported, utilizing X2-C interface for signaling and X2-U data traffic for split bearer testing.

The following functional test types available for O-CU Test DU Sim:

- X2 EN-DC Setup Procedure
- X2 EN-DC Configuration Update Procedure
- X2 Reset
- X2 EN-DC Partial Reset
- Secondary Node Addition (Option 3a, 3x)
- Secondary Node Release (Option 3a, 3x)
- Secondary Node Change (Option 3a, 3x)
- MeNB Change
- MeNB to eNB Change
- PCell Change
- Security Key Change Procedure
- Addition/Removal of SN terminated split bearer
- F1 Setup/Reset
- gNB-DU Configuration Update
- gNB-CU Configuration Update
- gNB-DU Resource Coordination
- gNB-DU Status Indication
- UE Context Setup/Release/Modification CU initiated and DU initiated
- UL/DL RRC msg transfer

Features of TeraVM O-CU Test DU Sim

- Portability – 1U Server based system, easy to transport and setup (Lab/Field)
- Simultaneously emulate large number of DU nodes at F1 interface to CU
- Deliver real traffic from large populations of UEs
- Test both 5G SA and NSA scenarios
- Supports X2-U data traffic for split bearer testing
- Single API for test case definition
- Lightweight – Deploy and configure in real-time
- Deterministic Performance – Outcome is always consistent.
- Time to Market – Frequent updates to most recent 3GPP specifications

Benefits of TeraVM O-CU Test DU Sim

- X86 Server based HW gives flexibility for multiple users to share the test system increasing the ROI
- Highly scalable reducing hardware obsolescence issues
- Works seamlessly with sister products TM500 and TeraVM so that engineers familiar with other VIAVI products have a faster ramp-up time
- Works with TeraVM Core Emulator to enable O-CU testing to be done in a stable and constant environment giving increased reliability and boosting productivity by avoiding the constant changes to a real core
- Automation and scripting to speed up testing and thereby also increase engineering productivity and optimize customer experience

First to Market 3GPP Standards Test Alignment

VIAMI has the largest dedicated 4G and 5G R&D team of any test company focusing on gNB, Core Network test. We work closely with our key customers to ensure that our roadmap is aligned to market needs and that we deliver test capability first.

Specification and Configuration

The O-CU Test DU Sim consists of the following network function and interfaces:

Network Functions

- O-DU Emulator

Interfaces

- F1
- X2

The implemented features are according to the following specifications: (Contact VIAMI for latest Spec compliance)

- 3GPP TS 36.423: E-UTRAN – X2 Application Protocol
- 3GPP TS 38.473: NG-RAN F1 Application Protocol

Hardware Specifications

The TeraVM O-CU Test DU Sim is based on the POWEREDGE R740 server with the following specifications below:

Features	Technical Specifications
Processor	Two Intel® Xeon® Scalable processors, 18 cores per processor
Memory	192 GB ECC DDR per server
Power Supply	Platinum Hot plug power supplies with full redundancy
Dimensions	Form factor: Rack (2U) Max depth: 752 mm
Power dissipation	550W/ 700W/ 850W maximum for 0/ 1/ 2 Radio Cards



VIAVI O-RAN Portfolio

In the Lab VIAVI test tools are used to verify 5G telecommunications equipment prior to launch:

- **TM500** – Emulate thousands of UEs to test the gNB. Additionally, emulate the O-RU to test the O-DU (TM500 Fronthaul options)
- **TeraVM O-CU Test DU Sim** – Simulates an O-DU to test the O-CU across the F1 interface
- **TeraVM Core Test** – RAN Emulator capable of emulating millions of UEs and 10' of thousands of base stations to test a Core Network.
- **TeraVM Core Emulator** – Emulates a 4G, 5G NSA or 5G SA Core network to test a base station

In the field VIAVI provides test tools to install, configure and turn up base station equipment:

- **3Z Antenna Alignment tools** – Aligns antenna for maximum efficiency, reports out of alignment
- **Cell Advisor** – 5G beam forming analysis, coverage plotting and interference analysis for 5G
- **T-BERD/MTS-5800** – Ethernet tester, Network synchronization test

In service monitoring and assurance tools:

- **NITRO Fusion** – Network performance monitoring via active test agents
- **NITRO Mobile** – Capture, locate and analyze all mobile events across RAN and Core to optimize customer experience



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