Brochure

VIAVI
TM500 O-RU Tester

Conformance, Performance
and Interoperability Testing
of the O-RAN Radio Unit

**Part of the VIAVI
O-RAN Test Suite**

Allowing customers to ensure conformance, interoperability and performance test

Open RAN Testing with VIAVI

With the greater complexities of testing disaggregated networks, it is vital to adopt the right test strategy and choose scalable tools that can support your overall needs.

Whether your requirements include end-to-end performance testing of a multi-vendor solution with interoperability between those multi-vendor components or whether you require component conformance testing with the ability to test the interoperability and performance of both individual and combined components, VIAVI has the tools to support you.

With a larger range of network components it is vital to select scalable test tools that can support you, not just for conformance testing but can be used for full closed loop signalling to support a range of real-world test scenarios including large numbers of UEs, mobility, mixed traffic types and maximum data rates.

Testing the O-RAN Radio Unit (O-RU) with the TM500

The VIAVI TM500 O-RU Tester covers a wide range of test capabilities, allowing customers to ensure conformance, inter-operability and performance testing including real-time generation of the O-RAN Control/User/Synchronization/Management plane messaging for the I/Q data stream. The TM500 O-RU Tester supports interoperability validation for different vendor O-RUs, addressing key challenges seen with testing within the O-RAN test framework.

Conformance, interoperability and performance testing

Fully stateful testing over the O-RAN Open Fronthaul interface

Extensions to characterize and optimize performance of 5G NR

Conformance, Performance and Interoperability

Conformance testing involves performing specific tests according to O-RAN specifications:

Example: Conformance testing of the C,U,S and M planes according to Working Group 4 O-RAN standards

Although conformance testing is important, testing it alone is not enough. Infrastructure might meet certain standards when elements are tested independently, but when it comes to interoperability, you need to make sure you can guarantee what you are testing will function as part of an end-to-end architecture, alongside other elements.

Beyond Conformance Testing

Think of it like testing white goods to check that they conform to industry standards. You do the necessary checks, the product passes, and you stamp it with a 'CE' mark. All good? Not quite. You then try and switch it on and although it meets the required specs, the product doesn't actually work.

Transport and Application Layer Performance

The O-RU is a network entity, it is therefore necessary to ensure that performance is acceptable at both the transport and application layers e.g. synchronization and timing issues at the O-RAN fronthaul layer should not affect any applications, especially latency-sensitive applications such as voice over NR.

Functionality Requirements

We understand that each of our customers will have different requirements in terms of the functionality of the O-RU e.g. different frequency bands, MIMO schemes etc. Infrastructure must be tested to ensure interoperability with these requirements. This ensures for instance that the M-plane is able to cope with different vendor requirements, ultimately facilitating end-to-end testing without any performance compromises.

Scalable Test Platform

With a greater scope of components in an Open RAN environment, it is important to select scalable test tools that can support not just conformance testing but can be upgraded to do performance tests at the higher layers e.g. the 5G stack. This will support a range of real-world test scenarios including large number of UEs, mobility, mixed traffic types and maximum data rates. The TM500 O-RU Tester has a scalable architecture, making it both a stepping stone to; and complementary to full end-to-end testing and works seamlessly with other VIAVI tools in the VIAVI 5G O-RAN portfolio.

Configure Test ▶

Load Test File

Execute Test

Log Analysis

3GPP-38-141-1 Base Station (BS) Transmitter Conformance ▶

3GPP-38-141-1 Base Station (BS) Receiver Conformance ▶

WG4.CONF M-Plane Measurements ▶

WG4.CONF S-Plane Functional Conformance ▶

WG4.CONF S-Plane Performance ▶

WG4.CONF UC-Plane Conducted FDD NR Generic (NRG) ▶

WG4.CONF UC-Plane Conducted FDD Beamforming (BFM) ▶

WG4.CONF UC-Plane Conducted FDD Compression (CMP) ▶

WG4.CONF UC-Plane Conducted FDD Delay Management (DLM) ▶

WG4.CONF UC-Plane Conducted FDD Section Type 3 (ST3) ▶

WG4.CONF UC-Plane Conducted TDD NR Generic (NRG) ▶

WG4.CONF UC-Plane Conducted TDD Beamforming (BFM) ▶

WG4.CONF UC-Plane Conducted TDD Compression (CMP) ▶

WG4.CONF UC-Plane Conducted TDD Delay Management (DLM) ▶

WG4.CONF UC-Plane Conducted TDD Section Type 3 (ST3) ▶

WG4CONF M-Plane Tr
WG4CONF M-Plane Ma
WG4CONF M-Plane Co
WG4CONF M-Plane Re
WG4CONF M-Plane Fa
WG4CONF M-Plane Sc
WG4CONF M-Plane Sc
WG4CONF M-Plane Ac
WG4CONF M-Plane Ex
WG4CONF M-Plane O-
WG4CONF M-Plane AL
WG4CONF M-Plane Lo
WG4CONF M-Plane Co

NETCONF Server Sess
Running Test Case - BS
Generating UC-Plane d
UC-Plane data generate
VSG sending downlink s
VSA analysing base sta
Measured base station
Running Test Case - BS
Generating UC-Plane d
UC-Plane data generate
VSG sending uplink sign
VSE measuriing BER
Measured BER:0.00%--

= 1000

00

= 0

10000

default/ttext

Conformance testing is important, NEMS and Operators must go beyond that

1.21   1.38   1.11
          0.65
2.94   15.00   5.92   1.61
0.00   0.04   -0.03

0 / 2 / 4   PUSCH 0

Sync Found

Conformance
testing with the
ability to validate
the interoperability
and performance of
both individual
and combined
components

Reference Sensitivity Level

Dynamic Range

BS-In-band Selectivity Blocking ▶ BS In-band Se

BS Out-of-band Blocking BS In-band Blo

BS Receiver Spurious Emissions

Receiver Intermodulation ▶

In-channel Selectivity

plane-interfaces

plane-interfaces

urn:o-ran:mplane-interfaces

4334 urn:o-ran:mplane-interfaces

830 urn:o-ran:mplane-interfaces

How the TM500 O-RU Tester Works

The TM500 O-RU Tester implements the O-RAN Distributed Unit (O-DU) side of the M-plane and C/U-plane functionality necessary to configure the interface with the O-RAN Radio Unit (O-RU) under test and exchange of I/Q data over the U-plane. The solution provides S-plane PTP and SyncE Grandmaster capability as well as being able to operate in PTP client mode to allow synchronization with an external PTP Grandmaster.

The TM500 O-RU Tester NETCONF client supports stateful M-plane. The O-DU cycles through typical M-plane procedures and establishes a link with the O-RU. The O-DU emulator C/U-plane engine, generates real-time eCPRI packets from downlink signal generated by the Vector Signal Generator (R&S®SMW200A). eCPRI packets are transported to O-RU via the Open Fronthaul interface. Vector Signal Explorer (R&S®VSE software) software and a Vector Signal Analyzer (R&S®FSVA3000 or R&S®FSW) support the analysis of downlink signal from the O-RUs transceiver port.

The O-RU receives uplink signal via the O-RU Rx port from Vector Signal Generator. Uplink U-plane eCPRI packets are transported to the O-DU emulator via the Open Fronthaul interface in response to the Uplink focused C-plane packets received by O-RU. Time domain uplink signal is analyzed using R&S®VSE software. The TM500 O-RU Test Manager Application (O-RU TMA) follows the philosophy of single point of control where it enables the user to configure, manage, analyze and generate test case reports all from the same application.

Key Features

- NETCONF Client to support Start-Up and get/edit configuration of M-plane attributes in the O-RU under test
- O-RAN C/U-plane functionality to exchange I/Q data over Lower Layer Split 7–2x interface
- Real time C/U-plane eCPRI packets generation
- Embedded protocol analyzer for OFH traffic analysis
- C/U-plane messaging support with eCPRI over Ethernet
- PTP/SyncE Grandmaster + PTP Client for Synchronization with external PTP Master
- OFH interface connectivity monitoring
- Wide range of synchronization topologies
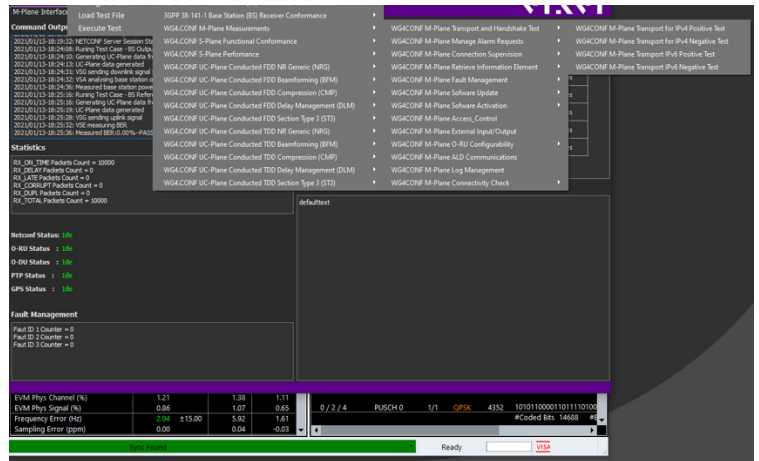- Multiple options for stimulus waveform generation
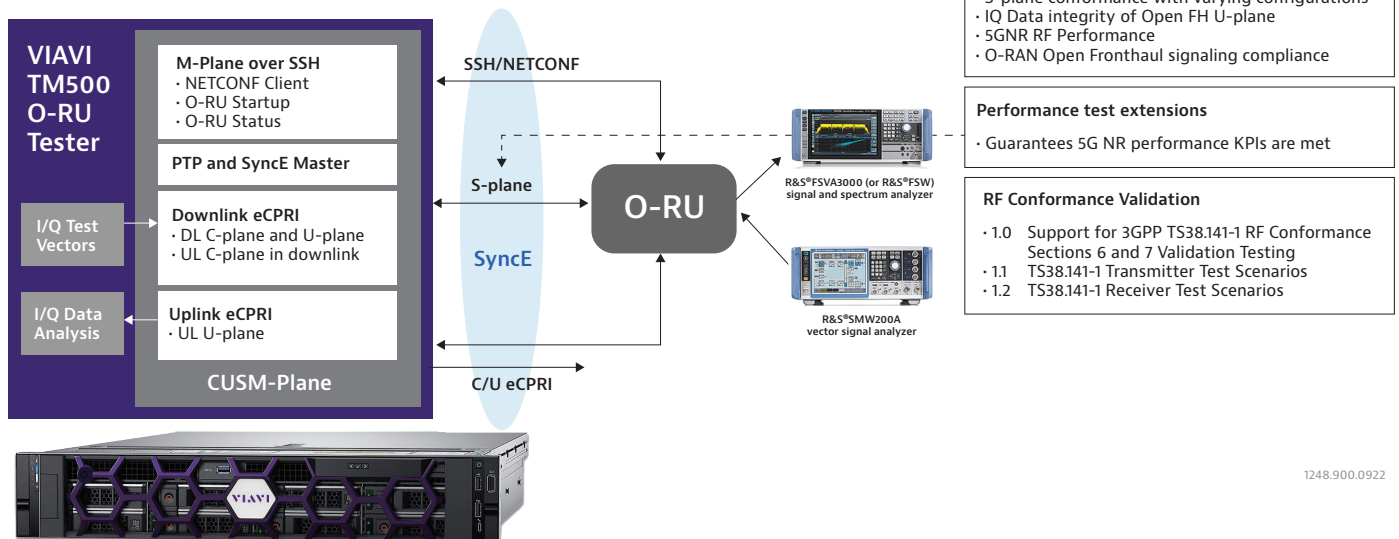
TM500 O-RU Tester Overview

1248.900.0922

7

TM500 O-RU Test Manager Application (TMA)

M-Plane Validation

- Transport Connectivity

- M-plane Start-up of O-RU

- NETCONF Subscriptions

- Performance Measurements

- M-plane Connection Supervision

- O-RU Information Retrieval and Configurability

This is the screen grab of M-plane measurements conformance test tree.
Test cases are ordered to mirror the specification document.

TM500 O-RU Test Manager Application follows the philosophy of single point of control where it enables the user to configure, manage, analyze and generate test case reports all from the same application.

Validation of Open Fronthaul C/U-plane Performance

- U-Plane I/Q Data Integrity

- RF Performance for 5G NR

- Test Case Flexibility
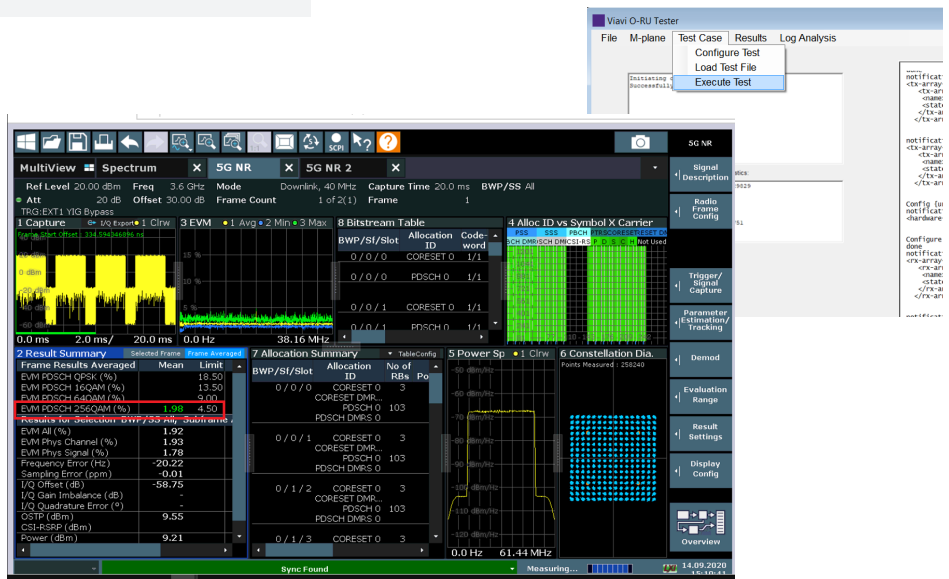
Proven with real vendor O-RUs

Fully stateful real-time solution to test O-RAN CUSM procedures

VIAVI TM500 O-RU Tester extensions

Validation of Open Fronthaul C/U-Plane Signaling

- O-RAN Standards Compliance of C/U-plane

- Sophisticated and familiar log analysis tool set

O-RU S-Plane Test Use Cases

- Leverage VIAVI extensive experience in ethernet test including transport synchronization

- Provision of PTP Master compliant with ITU-T G.8275.1

- Retrieval of O-RU State Parameters utilizing M-plane

  - Sync State

  - PTP Lock State

  - PTP State

  - PTP Clock-class

  - Sync-E Lock-state

  - Sync-E Quality-level

- Validate UL/DL C/U message timing relative to PTP Master time reference

> TM500 O-RU Test cases are configured by:
>
> - 3GPP 38.141 Section 6 and 7 Conformance
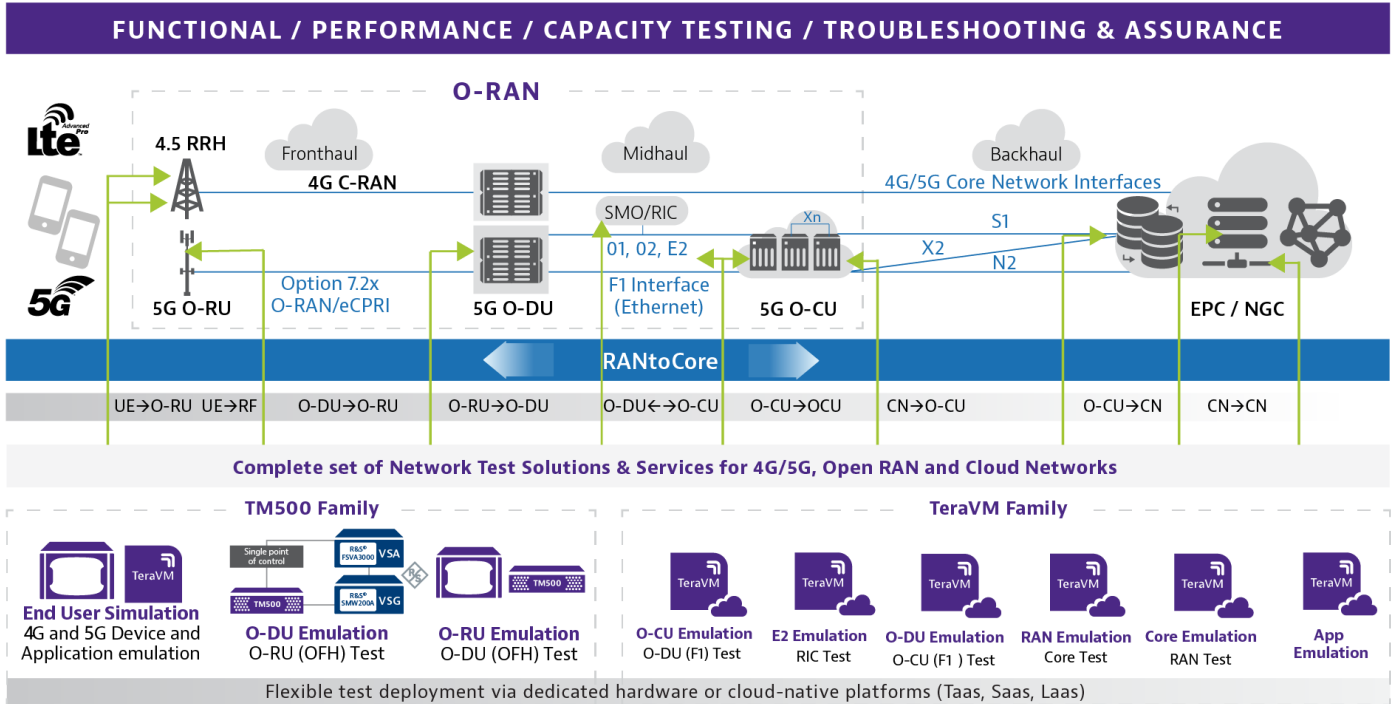> - O-RAN Working Group 4 Conformance

Partnering to deliver the best test capability for our customers

The TM500 O-RU Tester is designed to work with the Rohde & Schwarz Vector Signal Generator, Vector Signal Analyzer, and VSE software under a single point of control in TM500 O-RU TMA. The full specifications for the Rohde & Schwarz products can be obtained from the R&S website.

VIAVI O-RAN Test Suite

Performance; Conformance; Function; Load; System and Multi-vendor Interoperability Testing

FUNCTIONAL / PERFORMANCE / CAPACITY TESTING / TROUBLESHOOTING & ASSURANCE

O-RAN

Lte Advanced Pro	4.5 RRH	Fronthaul **4G C-RAN**		Midhaul				Backhaul **4G/5G Core Network Interfaces**	
5G	5G O-RU	Option 7.2x O-RAN/eCPRI	5G O-DU	SMO/RIC 01, 02, E2 F1 Interface (Ethernet)	Xn	5G O-CU	S1 X2 N2	EPC / NGC	

RANtoCore

UE→O-RU UE→RF	O-DU→O-RU	O-RU→O-DU	O-DU←→O-CU	O-CU→OCU	CN→O-CU	O-CU→CN	CN→CN

Complete set of Network Test Solutions & Services for 4G/5G, Open RAN and Cloud Networks

TM500 Family

End User Simulation
4G and 5G Device and Application emulation

Single point of control / TM500 / R&S® FSVA3000 VSA / R&S® SMW200A VSG

O-DU Emulation
O-RU (OFH) Test

O-RU Emulation
O-DU (OFH) Test

TeraVM Family

O-CU Emulation
O-DU (F1) Test

E2 Emulation
RIC Test

O-DU Emulation
O-CU (F1) Test

RAN Emulation
Core Test

Core Emulation
RAN Test

App Emulation

Flexible test deployment via dedicated hardware or cloud-native platforms (Taas, Saas, Laas)

1049-3.900.0722

viavisolutions.com/wirelessvalidation