VIAVI Solutions

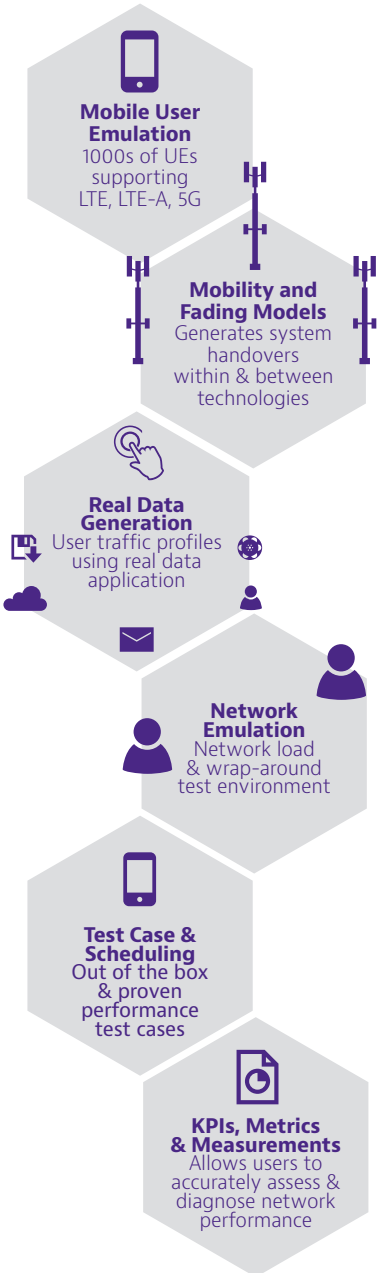
Data Sheet

VIAVI

Testing O-RAN 5G Base Stations using the TM500-C 5G Test Mobile Family

Test Mobile

TM500 5G Test Mobile Family supports direct interface to the Distributed Unit (O-DU) via eCPRI



Key Features and Benefits

- Extends capabilities of market leading TM500 Test Mobile that is used extensively by the world's leading vendors and operators
- New interface and software options to interface directly to O-DU without an O-RU present
- Support multiple O-RAN profiles to ensure interoperability against a wide range of Radio Units and vendors
- Ensure delivery of commercially robust gNBs and software that support high numbers of subscribers consuming large amounts of data
- Test using real world data flows at high scale with realistic mobility modeling

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:

- **Limited O-RU test capability and working with new vendors** If new vendors or solutions are used, it will be essential to conduct thorough testing to ensure no degradation of the overall stability, robustness and performance of the gNB.
- **Challenge of guaranteeing performance with scale and capacity** E.g. ensuring that the O-DU can cope with high data rates and multiple 5G carriers.
- **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-RU and O-DU 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, O-RU management and state changes.

Why VIAVI?

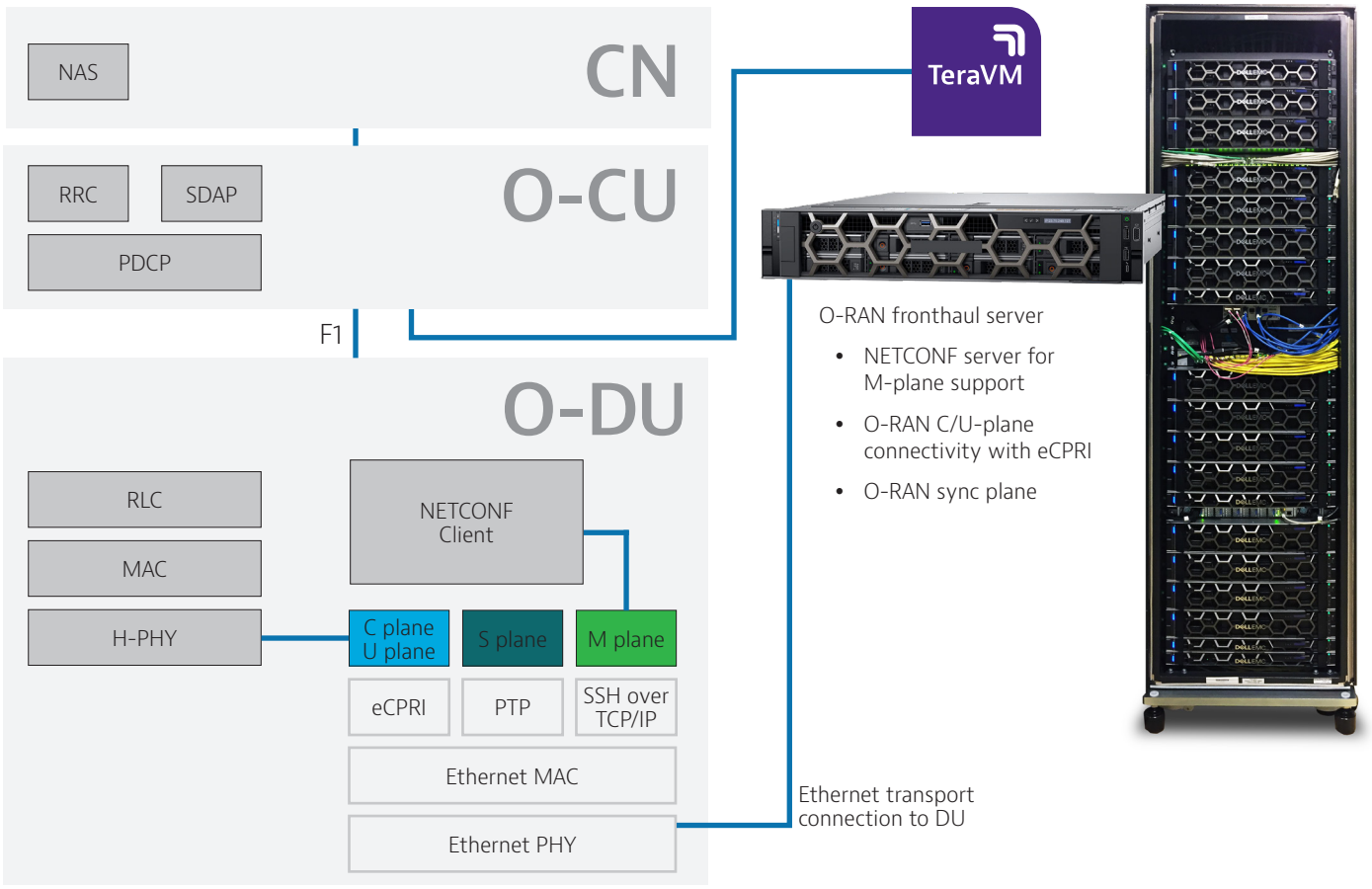
VIAVI has an end-to-end O-RAN product portfolio for multi-vendor RAN development, test and IoT. VIAVI is a one stop shop, simplifying the complexity of testing different O-RAN interfaces across the network. Customers can rely on an unparalleled global support footprint, reduced complexity of integration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

Why TM500?

- **Ability to test RUs with different profiles from different vendors** can be complex and expensive as may need multiple test lines. The TM500 fronthaul solutions allow multiple RUs from different vendors to be tested including having different profiles. This reduces complexity and cost of testing.
- **O-RAN fronthaul is an extension of the TM500** which has an unparalleled global support footprint to assist customers in expediting delivery and deployment around the world.
- **Development of O-RAN 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.
- **Access to leading TM500 3GPP features over O-RAN**: With seamless access to already leading 3GPP 5G features supported over RF, this means that customers can expect no performance compromises with feature combinations. E.g. testing the latest high order Carrier Aggregations and MIMO.
- **Leverage TM500 leading capacity testing, mobility support and interoperability with legacy RATs like 4/4.5G:**
  - The TM500 5G already supports today 1000's of UEs with a rich KPI set for network performance testing over RF.
  - 5G functionalities supported over RF can be accessed over O-RAN as it matures. This is important to operators for network performance testing and inter-operability with 4/4.5G where the TM500 clearly leads.
  - All mobility scenarios are supported over 5G key as the deployment scenarios become more complex.



In addition to the rich set of KPIs already supported within the TM500 products, the following additional KPIs will be available for O-RAN fronthaul performance testing.

#	Applicability	KPIs
1	C/U plane receiver statistics	RX_ON_TIME
2		RX_EARLY
3		RX_LATE
4		RX_CORRUPT
5		RX_DUPL i.e. duplicate
6		RX_TOTAL
7	Status information	O-RU M-plane status
8		O-RU S-plane sync status
9		O-RU C/U plane connection status
10		O-RU status

As is traditional with the TM500 family of products, the KPIs are augmented owing to different customer requirements and test methods.

TM500 O-RAN Fronthaul Product Capability

A summary of the key TM500 O-RAN fronthaul capabilities are found below:

#	Capability	Supported	Comment
1	O-RAN Fronthaul server	1 server/ 2 x 25GbE NIC per server	3, Cat B servers per E500
2	O-RU/NIC mapping	Up to 2 O-RU per Fronthaul server	Phased as per customer requirements
3	CC/MIMO O-RU mapping	2x CC 2x2MIMO, 1CC 4x4MIMO per O-RU	2CC 4x4 and 4CC 2x2 phased
4	Transport	10/25 Gb Ethernet	A Single-Mode or Multi-Mode fibre SFP28 module can be used in each of the SFP cages
5	Transport Header	eCPRI	
6	Radio Access Technology	5G NR TDD, 5G NR FDD and 4G over RF	
7	O-RU category	CAT A, CAT B	Phased as per customer requirements
8	M Plane support	Full M-plane startup procedure supported. Supported database is customizable	With NETCONF connectivity support between DU client and O-RU server utilizing SSHv2
9	Separation of C/U and M Plane traffic	EtherType, VLAN ID	
10	C-Plane Section Types	0, 1 and 3	
11	Compression	Block Floating Point, modulation compression	
12	Section extension types	1,4,5,6,11	
13	O-RAN WG4.CUS.0-v02.00 Timing Parameters	Aligned with numerology	
14	Frequency	FR1, FR2	
15	PRACH preamble format	Configurable	
16	Nominal Sub-carrier Spacing	FR1 30 kHz, FR2 120 kHz, with mixed numerology support (e.g. 240KHz/120KHz) (SSB 120 kHz)	Phased as per customer requirements to align with TM500 RF capability.
17	Channel Bandwidth	All channel bandwidths up to 100 MHz	Other bandwidths phased as per customer requirement.
18	Downlink MIMO support	2x2 and 4x4 MIMO	
19	Uplink MIMO support	2x2 MIMO	
20	MU-MIMO	4 layers FR1 32TRX 2TRX UE	
21	Beamforming	Digital on FR1 and analog on FR2	
22	TM500 Test Modes	As per RF	MTS, NAS, PDCP

Hardware Specifications

The TM500 O-RAN front 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

Ordering Information

Find below the ordering codes:

Type	Part Number	Comment
Hardware	TK1046 - O-RAN Fronthaul Server	• Up to 2 per E500 • Support up to 2 O-RU per server • 2x 25GbE NIC per server • 2x CC 2x2MIMO, 1xCC 4x4MIMO per O-RU
Software	TK2072 - TM500 5G NR O-RAN FH OPT 7-2 - 8 LAYERS 1RU	• See O-RAN product capabilities for further details
Software	TK2041 - TM500 5G NR O-RAN FH OPT 7-2 - mMIMO MU-MIMO FR1 CAT-A 32TRX, 4 LAYERS	• See O-RAN product capabilities for further details
Software	TK2071 - TM500 5G NR O-RAN FH OPT 7-2 (4 LAYERS, 1 O-RU)	• See O-RAN product capabilities for further details
Software	TK2073 - TM500 5G NR O-RAN FH OPT 7-2 (2 O-RUs)	• See O-RAN product capabilities for further details
Software	TK2107 - TM500 5G NR O-RAN FH OPT 7-2 - NON CONTIGUOUS PRB SUPPORT	• See O-RAN product capabilities for further details

VIAVI Validation, Verification and Visibility

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's 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 and configure 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
- **MTS5800** – 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

Related VIAVI Test Solutions

The CellAdvisor 5G complements the TM500 5G for monitoring and accelerating troubleshooting of 5G RF channel performance. Its main 5G test functions include:

- Real-time spectrum and interference analysis with persistence display for 5G FR1 (Sub-6 GHz) and FR2 (mmWave)
- 5G carrier scanner measuring up to eight 5G carriers' power as well as strongest beam power level and corresponding identifier (ID)
- 5G beam analyzer measuring individual beams and indicating corresponding identifier, power level and signal-to-noise ratio
- 5G route map for coverage verification, mapping the physical cell identity (PCI) and beam strength in real-time, as well as providing coverage data for post-processing

CA5G also supports the following performance indicators:

- g/eNB channel bandwidth
- Channel center frequency
- Cell IDs
- Modulation quality
- Received power
- Active antenna beam performance
- Channel stability

*All specifications are subject to change without notice

The VIAVI TeraVM Core Emulator adds to the capabilities of the industry-standard TM500 test mobile to provide a full wrap-around test of a 5G gNB for 5G Non-standalone (NSA) and (SA) mode. It supports the following feature:

- First to market alignment with 3GPP standards
- Runs in lightweight VM on standard x86 hardware
- Automation and scripting tools
- Negative testing via error generation on N2 interface
- Alignment and compatibility with TM500 test mobile
- One-stop test support
- View all Core Network KPIs on one GUI

VIAVI Solutions

Contact Us **+1 844 GO VIAVI**
(+1 844 468 4284)

To reach the VIAVI office nearest you,
visit viavisolutions.com/contact

tm500-oran-testing-ds-wir-nse-ae
30191008 903 0821