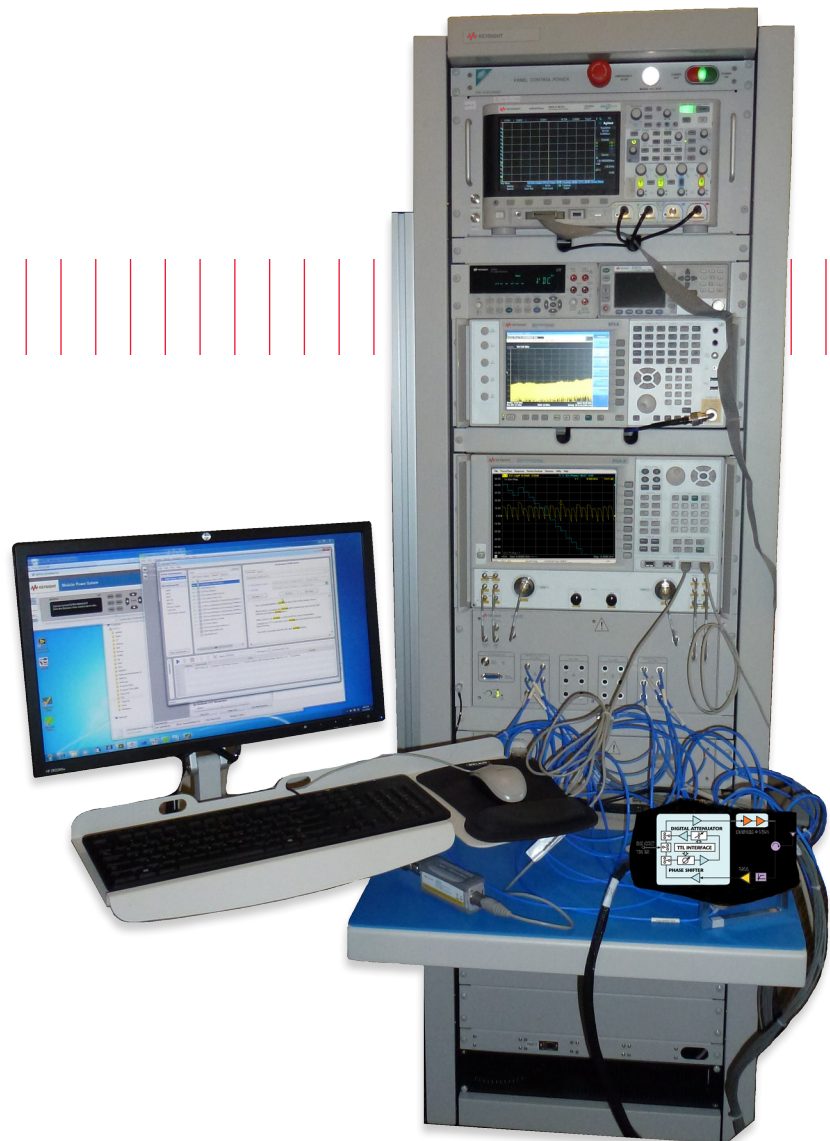


Keysight Technologies Transmit/Receive Module Test Platform (TRM-X)

Technical Overview



Z2095B-400 Aerospace Defense TRM-X Test Platform

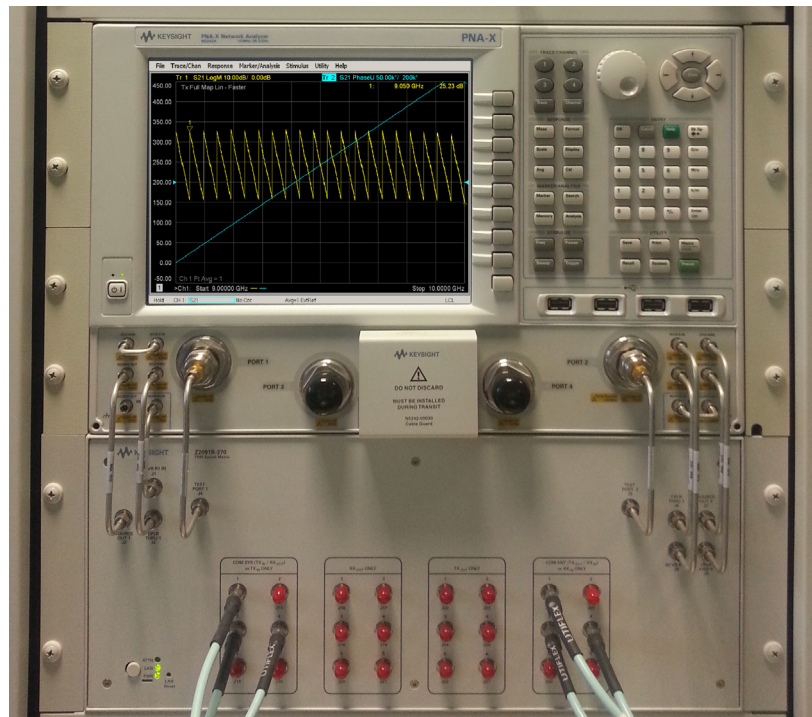
The Z2095B-400 Aerospace Defense TRM-X Test Platform, when coupled with Keysight's world wide support capability, measurement science expertise and ability to deliver systems when and where needed, can provide you with all of the T/R module (TRM) test capability you need to develop and test AESA radar; datalink; and satcom transmit/receive modules.

Platform Product

TRM-X is a platform solution, where typically 80% of the test system can be standardized. The remaining 20% is specific to the Device Under Test (DUT) and must be flexible for support and customization. The platform concept includes a standard product architecture that meets the major part of the test needs for a DUT. As a standard product the platform has a number of available options to increase the capability of the standard design. Keysight has put in place the infrastructure and the processes to tailor and/or customize the product even further to meet 100% of the test needs. Platform based solutions include not just the specific hardware required by a customer, but also the software, training, consulting, support, and service needed to ensure a complete solution.

The Keysight Platform Product Concept

- Maximizes the use of commercial off the shelf (COTS) products.
- Includes hardware, application software, and system software.
- Keysight's development infrastructure and processes provide a solution that is easily repeated, updated, and maintained.
- A solution that goes beyond integration and includes long term hardware and software support.
- A system platform that is linked to future instrument development.
- Leverage Keysight measurement science and test solution expertise.



Key Features and Benefits

Specialized hardware and the latest instruments maximize asset life and lower overall cost of test

- Best measurement technology with X-Series instruments.
- Flexible DUT control and easily configurable using COTS FPGA.
- Easily scalable and optimized from development to production.

Instrument upgrades linked to the test system ensure higher return on assets (ROA)

- Keep up with latest measurements/RF formats allowing faster response to technology and product turn-over.

World-class measurement technique expertise increase reliability and reduce production cost

- Stable and repeatable measurements.
- Improved correlation across systems using Keysight instruments in development and production.
- Multi-DUT capability with simultaneous testing, loading and unloading of multiple devices.
- Keysight brings expertise in the trade-offs between performance, cost, speed, reliability, ease of use, and flexibility

Platform developed to greatly reduce Non-Recurring engineering cost

- Industry standard test sequencer, and languages.
- Faster test process development.
- The end user can easily customize the system as necessary
- Less resource required for each New Product Introduction.

System Calibration increases repeatability and product yield

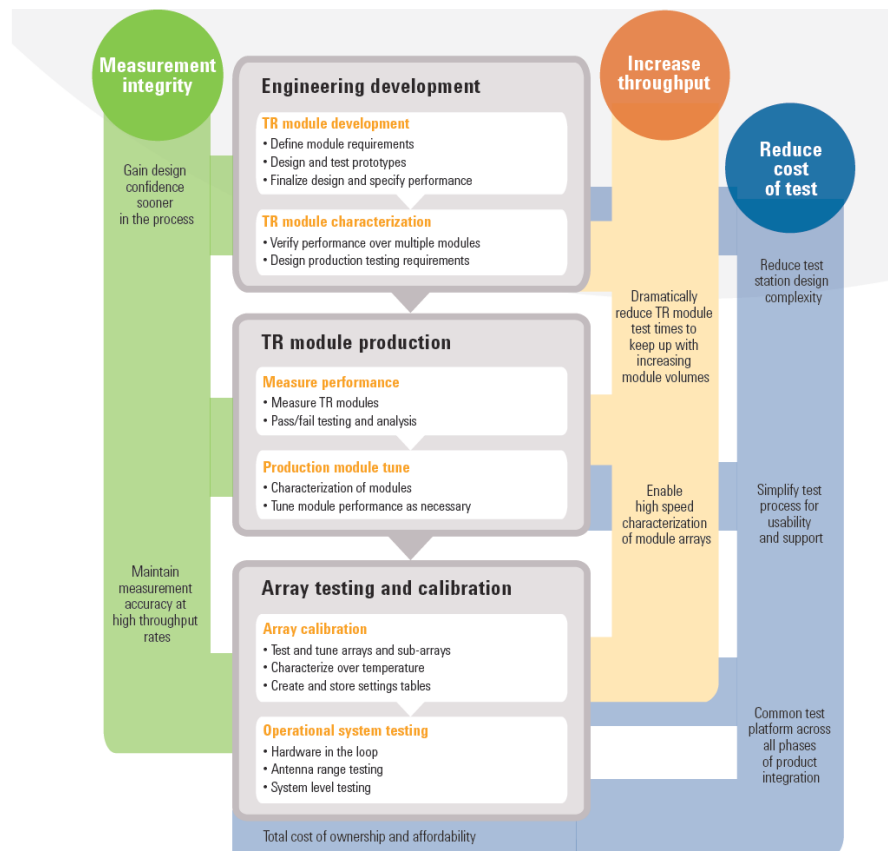
- Accurate system calibration.
- Simple tools for RF path calibration data.
- Correlation across test systems.
- Specify system reference plane at DUT ports.

Software optimized for greater throughput and lower production cost

- Open, scalable software environment.
- Immediate usability with platform framework.
- Full access to all system resources for local customization.
- Best in class tools (C#, LabVIEW, TestStand).

Comprehensive support decreases total cost of test system ownership

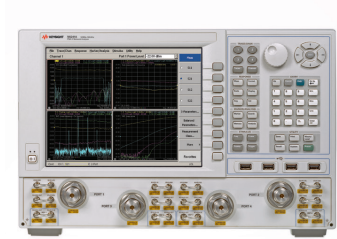
- Globally coordinated, locally delivered, full-service support.
- Tailor support by site.
- Customer supportable for higher up-time.



System Instruments

The TRM-X is comprised of Keysight instruments and switching hardware specifically designed for the TRM test environment. Measurements are implemented with a core of X-Series instruments such as the PNA-X, MXA or PXA, and InfiniiVision oscilloscope. The X-Series instruments are an evolutionary approach to signal analysis that spans instrumentation, measurements and software. They give the flexibility to satisfy business and technical requirements across multiple products and programs – now and in the future.

PNA-X Network Analyzer



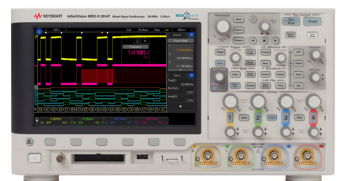
The world's most integrated and flexible single-connection microwave test engine for measuring active devices such as amplifiers, mixers, and frequency converters. Available in various frequency ranges up to 8.5GHz, 13.5GHz, 26.5GHz, 43.5GHz, 50GHz, and 67GHz.

MXA Signal Analyzer



As standards evolve and cycles get shorter, each project demands tradeoffs and decisions about specification, capabilities, throughput, and yield. The MXA is a highly flexible signal analyzer that provides the versatility to adapt to changing test requirements.

InfiniiVision 3000 Oscilloscope



Keysight's InfiniiVision MSOX3014A, offers superior performance and optional capabilities that are not available in any other oscilloscope in its class. Keysight's breakthrough technology delivers more scope for the same budget.

N1912A Power Meter



The Keysight P-Series power meters provide peak, average, peak-to-average ratio, max, min, rise/fall time, and statistical measurements. With the N192XA wideband power sensors, provides a measurement frequency range from 50 MHz to 40 GHz with an internal zero and calibration capability.

N6700B Power Supplies



The Keysight N6700B is a 400 W 1U high, 4-slot modular power system mainframe that accepts from 1 to 4 N6700 series DC power modules in any combination. The platform supports multiple N6700B mainframes. Higher power options are also available.

Z2091B-370 TRM Switch Matrix



The Z2091B-370 TRM Switch Matrix is specifically designed to integrate using the PNA-X "loops" for high performance T/R module test. It is available in three frequency options: 18GHz, 26.5GHz, or 40GHz. It provides switching for up to six two-port DUTs and options to test multi-port DUTs (3 or 4 ports per DUT). It has capability to support internal or external amplifier.

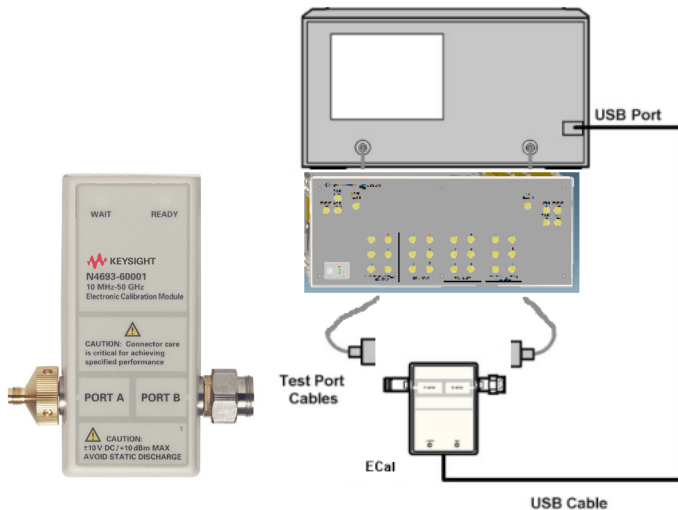
PXIe 18-Slot Chassis



Keysight's M9018A chassis provides the ultimate in flexibility, compatibility, and performance. 16 PXIe Hybrid slots allow a mix and match of PXIe and PXI-1 hybrid compatible modules for DUT control or measurement.

System calibration

- Using one of Keysight's ECal modules, system calibration is based on S-parameter measurements of paths, permitting better accuracy at the system test ports.
- De-embedding of the various adapters can be used while performing the PNA-X two-port calibration for high accuracy at the DUT.



- System calibration data can be archived.
- Enables the T/R module test engineer to define the calibration plane to be established. This can be especially important when these modules use non-standard connectors requiring custom calibration kits.
- Cal Pods can be used in-line to enhance calibrations without disconnecting a DUT, particularly when performing temperature/vacuum test.



- Cal Pods are ambient, temperature compensated or TVAC reflection transfer standards (i.e. Open, Short, Load) that are installed as close to the DUT as possible.
- Cal Pods allow a calibration to be automatically refreshed if the electrical parameters (of the path between the PNA-X and the Cal Pods) have changed between the original calibration (typically performed with E-Cal) and the current measurement without disturbing the DUT setup.
- Keysight's TRM-X test system supports the use of Cal Pods in low or high I/O count applications.

PNA Triggered S-Parameters Measurement

System Parameters		Transmit or Receive Test	DUT Path
PNA State File		Transmit	Programmed

Measurement Parameters	
Start Frequency (MHz)	9000
Stop Frequency (MHz)	10000
Number of Points	21
NumberOfAverages	1
IFBW (Hz)	2000000
Power (dBm)	-20
Port 2 Power (dBm)	-30
☐ Segmented Sweep	

Measurements	
☒ S21 Enable	☐ S12 Enable
☐ S11 Enable	☐ S22 Enable
☒ Measure Phase	

Pulse Timing (ms)			
	☒ Pulse DUT	PRI	20
TX Delay	1	TX Width	6
RX Delay	10	RX Width	6
PNA-X Src1 Delay	1.1	PNA-X Src1 Width	5.8
PNA-X Meas Delay	2	PNA-X Meas Width	3
MXA Meas Delay	2	MXA Meas Width	3

DUT States	
Phase States	64
Phase Start	
Phase Stop	
Atten States	64
Atten Start	
Atten Stop	

Ok Cancel

System Core

Industrial grade system cabinet

The TRM-X standard rack configuration is a single-bay 2m rack, a 1.3m option is also available. It provides rugged enclosure for instruments, well designed cooling to increase instrument life, protection for cables and instruments, expansion space, and well-designed ergonomics and a flexible DUT I/O capability.

Industrial PC

A controller that is supported world-wide, has ample expansion room (PCI and IA slots), a stable operating system and easy upgrade as PC technology evolves.

KVM Switch

Allows the operator to efficiently switch between PC and Rack Instruments to utilize a common control capability and improve productivity.

Flat Screen monitor, keyboard & mouse

Space saving operator interface on a swing arm that can be adjusted for best ergonomic fit.

AC Power Control

In-rack AC power distribution that supports power systems the world over. Emergency-Off button on the top, front of the rack for operator and facility protection.

Manufacture

The system is manufactured by Keysight's high quality Systems Network Division (SND) manufacturing organization, using processes developed specifically for aerospace and defense assembly and test. This ensures that each system is built and tested to rigid standards and significantly reduces any problem of inconsistent test results. This also ensures protection of proprietary and government information as required.



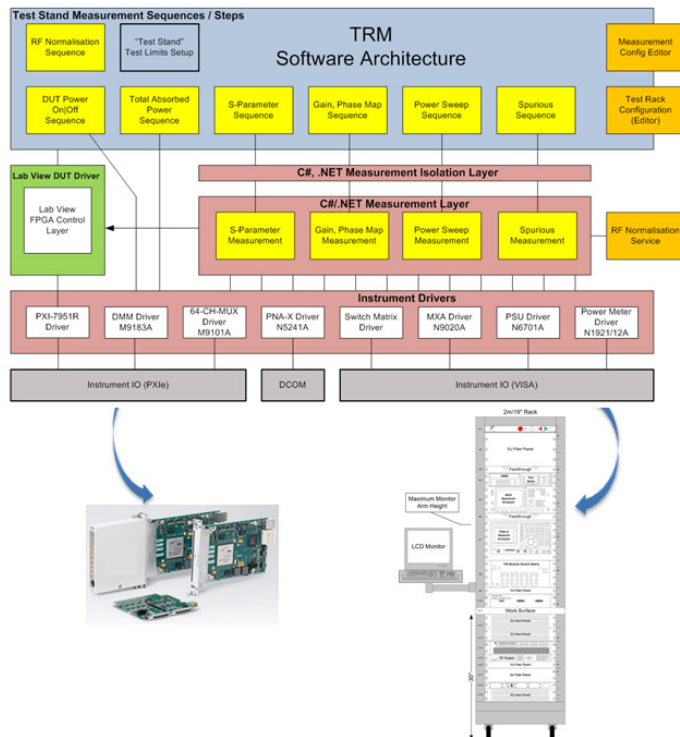
System Software

The TRM-X software framework provides software building blocks to handle RF path calibration data, measurement correction, system resources configuration, instrument control, and base measurement science. The test engineer has full access to all system resources for onsite, local customization.

Software Architecture

- A system platform permits the test engineer to enhance and add individual capabilities, such as new measurements and new instruments
- Increase Test Engineer productivity focus on test development vs. measurement coding

The diagram shows the software architecture. Objects in red are part of the platform framework and can be installed on their own. They include the measurements science, RF path correction, and management of system assets. The block in blue is the COTS test executive and items in yellow are support sequences in the test executive. The green block is the COTS FPGA DUT control.



- National Instrument TestStand is the COTS test executive for the TRM-X platform. It provides multithreaded autoscheduling for test throughput optimization.
- Logging of test results in Excel (.csv), XML, or custom formats.
- The software architecture provides immediate usability.
- The test engineer has full access to all resources and instrument applications for customization. Keysight factory support is not required by the customer should they choose to self-support.
- Keysight supplied measurement objects are written in C#.
- The architecture is open, allowing other solutions such as LabWindowsCVI, LabVIEW, legacy DLLs.

Measurement library

Measurements

- CW & Pulsed S-Parameters (S11, S12, S21, S22)
- High speed device characterization across multiple DUT Gain / Phase states
- CW & Peak RF Power
- Pulse profile
- Gain Compression
- Intermodulation Distortion / TOI
- Noise Figure
- Harmonic and Non-Harmonic Spurious
- AM to PM Conversion
- Static and Dynamic DC power

Refer to the Keysight instrument documentation for a comprehensive list of measurement capabilities.

- Correction of path effects, with interpolation when required.
- Switch paths are controlled via logical path names and not individual switch numbers.

Warranty

Keysight provides a 1-year return-to-Keysight warranty on custom systems. Warranty extension and custom repair strategies are available to meet your specific requirements. All Keysight COTS Instrument Products are covered worldwide with a three-year warranty as standard.

Service and Support

Keysight aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Keysight products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Keysight's overall support policy: "Our Promise" and "Your Advantage."

Our Promise

Our Promise means your Keysight test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Keysight equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage

Your Advantage means that Keysight offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra cost upgrades, out-of-warranty repairs, and onsite education and training, as well as design, system integration, project management, and other professional engineering services.

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

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