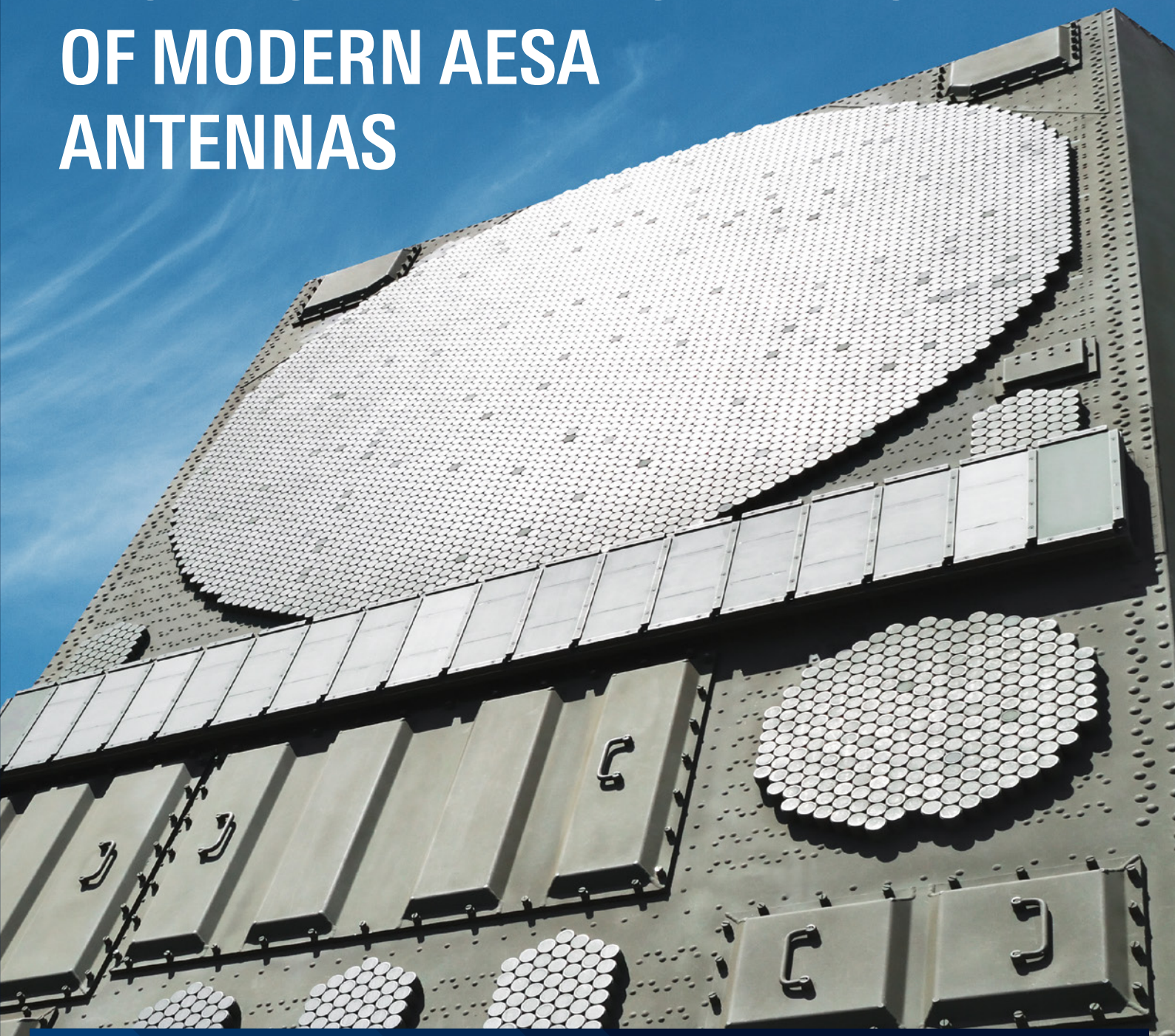
AESA and antenna testing

TESTING TRM PERFORMANCE OF MODERN AESA ANTENNAS



ROHDE&SCHWARZ

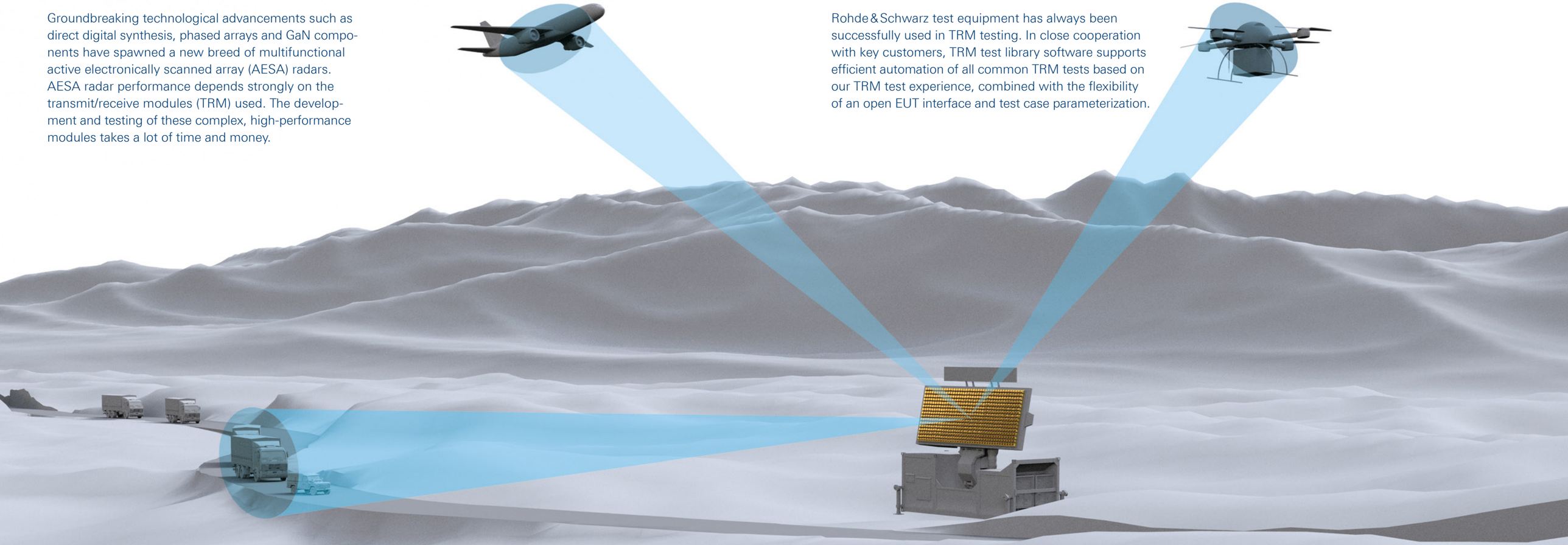
Make ideas real

YOUR CHALLENGE

Groundbreaking technological advancements such as direct digital synthesis, phased arrays and GaN components have spawned a new breed of multifunctional active electronically scanned array (AESA) radars. AESA radar performance depends strongly on the transmit/receive modules (TRM) used. The development and testing of these complex, high-performance modules takes a lot of time and money.

OUR SOLUTION

Rohde&Schwarz test equipment has always been successfully used in TRM testing. In close cooperation with key customers, TRM test library software supports efficient automation of all common TRM tests based on our TRM test experience, combined with the flexibility of an open EUT interface and test case parameterization.



Verifying the performance of individual TRMs in large arrays

State-of-the-art AESA radars contain several thousand TRMs and each TRM must be tested separately during development and production. Time-consuming testing limits production throughput and requires investment in many parallel test systems. Rohde&Schwarz has many years of experience with time-optimized TRM test routines and setups, combining high-performance test equipment with fast control handover while handling tens of thousands of test results per TRM.

Reducing complexity and effort for TRM testing

TRM testing can be complex and error-prone because the measurements needed for each TRM require different equipment, test setups and calibration routines and generate a large amount of test results. The automation software supports multiple measurements using a network analyzer and an optional spectrum analyzer without reconnection. When combined with the integrated calibration routine, this simplifies the setup ensuring full accuracy and high repeatability.

Turnkey systems and experience from a reliable partner

A lot of time and resources are needed to develop AESA radars and TRMs. Implementing and optimizing R&D and production tests increases this effort and increases time to market. Whereas radar and TRM development is a core competency of a company, TRM test requirements are very similar. Rohde&Schwarz provides high-performance T&M equipment and TRM test library software based on the company's many years of TRM testing expertise. The standard design of the R&S®TS6710 TRM radar test system, for example, can be adapted to TRM user requirements.

Testing TRMs with powerful test case libraries: fast and fully confidential

Even if the basic functions of TRMs are identical, each type of TRM has a unique design, interfaces and parameters. These factors are the core know-how of any TRM and AESA manufacturer, and subject to strict confidentiality. As a result, this often prevents manufacturers from using standardized test solutions. The open DUT interface of the TRM test library can be locally implemented by the customer, local integrator or Rohde&Schwarz. With this software interface, any control hardware can be implemented on site. In addition, time-optimized control routines for all common communications interfaces (e.g. LVDS, RS-422, RS-485, TTL) are available on the R&S®CompactTSVP modular platform for very short test times.

SOLUTION FOR HIGHEST TEST SPEEDS AND THROUGHPUT

Introduction

AESA radars consist of a large number of TRMs. Each TRM has to be characterized and – depending on the application – individually calibrated over a large number of DUT states and frequencies. This makes test time crucial as it defines the number of parallel running test systems in production.

Rohde & Schwarz solution

The TRM test library utilizes Rohde&Schwarz test equipment for top speeds in combination with fast control handover. Due to fast frequency sweeps and multiple measurements within one pulse, the number of required TRM state changes is reduced and overall test time minimized. With a signal conditioning unit, all tests run automatically, including port multiplexing. Typical test times for a complete TRM characterization can be reduced from several hours with legacy test systems to a few minutes. The R&S®TS6710 test system proves this every-day in countries around the world.

Key benefits

- ▶ Time-optimized test cases with TRM test library
- ▶ Fully automated testing with signal condition unit
- ▶ Scalable up to turnkey test system

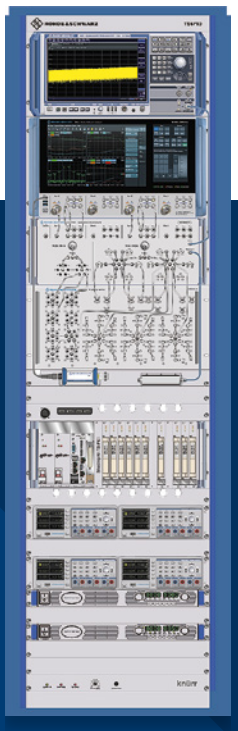
Want to learn more:

www.rohde-schwarz.com/product/ts6710

PC/R&S®ZNA/R&S®ZVA

PC/R&S®ZVA/R&S®ZVAX-TRM

R&S®ZNA/ZVA
R&S®OSP-TRM
R&S®TSVP including PC



Turnkey TRM test system

R&S®FSW spectrum analyzer
R&S®ZNA/ZVA
R&S®OSP-TRM
R&S®TS-MWM
R&S®TSVP
Power supplies

COVERING MULTIPLE TESTS WITH ONE SETUP

Introduction

When characterizing TRMs, many different measurements are involved, typically requiring a wide variety of test instruments. Configuration, calibration and measurement setups are complex and error-prone, for example due to an incorrectly connected cable. If a single instrument has a glitch, the whole setup can be rendered useless.

Rohde & Schwarz solution

The TRM test library supports all typical TRM test cases using a network analyzer. If higher performance is required (e.g. pulsed noise figure) a spectrum analyzer can be added. Users benefit from less complex setups and have to deal with fewer cables. In combination with a signal conditioning unit, all tests including multiplexing can be carried out without reconnection.

A special feature is the software calibration routine that compiles the test requirements into an overall optimized calibration sequence and does not compromise accuracy. Multiport calibration units permit efficient calibration of DUTs with many ports. A simplified test setup and high degree of automation ensure reliable and reproducible measurements.

Want to learn more:
www.rohde-schwarz.com/manual/ts6/chapter 5

R&S®TS6710 TRM.

R&S®TS6710 TRM test library test cases and typical hardware configurations

		R&S®ZNA	R&S®ZVA	R&S®ZVA, R&S®ZVAX-TRM	R&S®ZVA, R&S®OSP-TRM, R&S®cTSVP	Additional R&S®FSW
Test case	**Test mode**	**Supported modulation**				
		CW, pulsed	**CW**	**CW, pulsed**	**CW, pulsed**	**CW, pulsed**
S-parameter over DUT states	RX, TX	•	•	•	•	
Compression point	RX, TX	•	•	•	•	
Spurious emissions	RX, TX	•	•	•	•	•
Pulse profile (rise time, fall time, power droop)	TX	•		•	•	•
Noise figure	RX		•	• [1]	• [1)]	•
Out-of-band rejection	RX, TX	•	•	•	•	•
Harmonics	RX, TX	•	•	•	•	
Power added efficiency	TX	•	• [2]	• [2)]	• [2)]	
Intermodulation	RX		• [3, 4]	• [4)]	• [4)]	

[1] CW only.
[2] Requires a supported power supply.
[3] Requires a power combiner.
[4] Requires two internal VNA sources.

YEARS OF OUR EXPERIENCE BUILD INTO POWERFUL TEST LIBRARIES

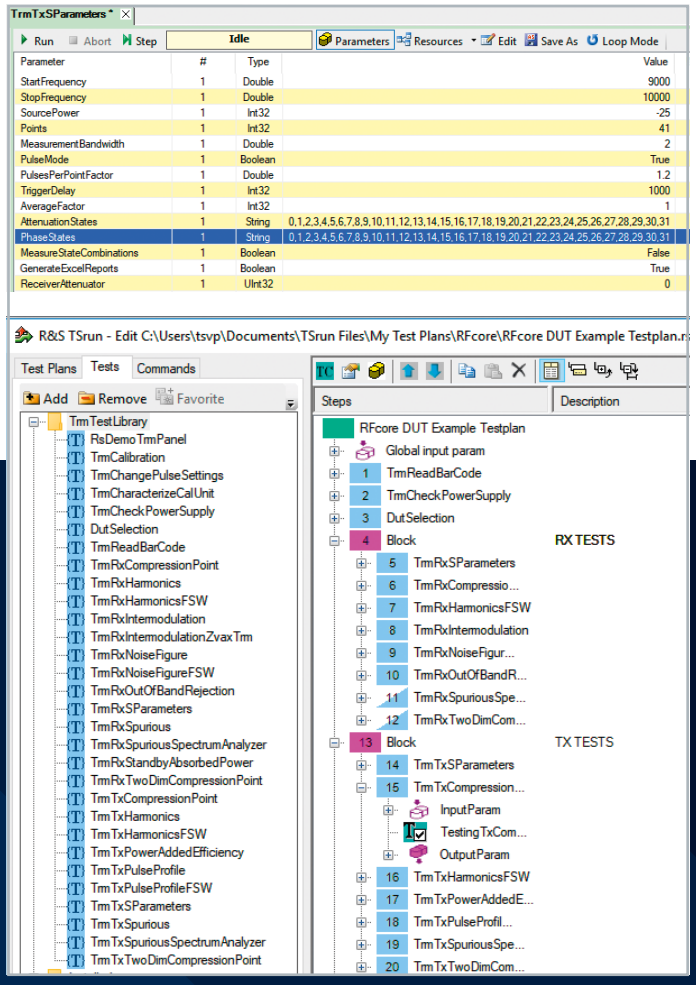
Introduction

Developing new AESA radars and TRMs with highly integrated components and special features requires expertise and is a real challenge for any company. Establishing the corresponding test stations and test routines for development and production requires additional expertise, taking resources from development.

Rohde&Schwarz solution

TRM development and production requires similar test routines, regardless of specific TRM features. The TRM test library covers these test routines based on the company's many years of experience in TRM testing. Specific TRM requirements are set via test case parameters in the software. Different test cases and test plans can be cloned and configured for different tasks such as component tests, module characterization or production. This makes measurements reproducible, efficient and easy. Integrated reports enable fast analysis and documentation, including pass/fail evaluation and detailed results, keeping testing to a minimum.

Want to learn more:
www.rohde-schwarz.com/product/ts6



TRM test library.

OPEN DUT INTERFACE ENSURES CONFIDENTIALITY AND FLEXIBILITY

Introduction

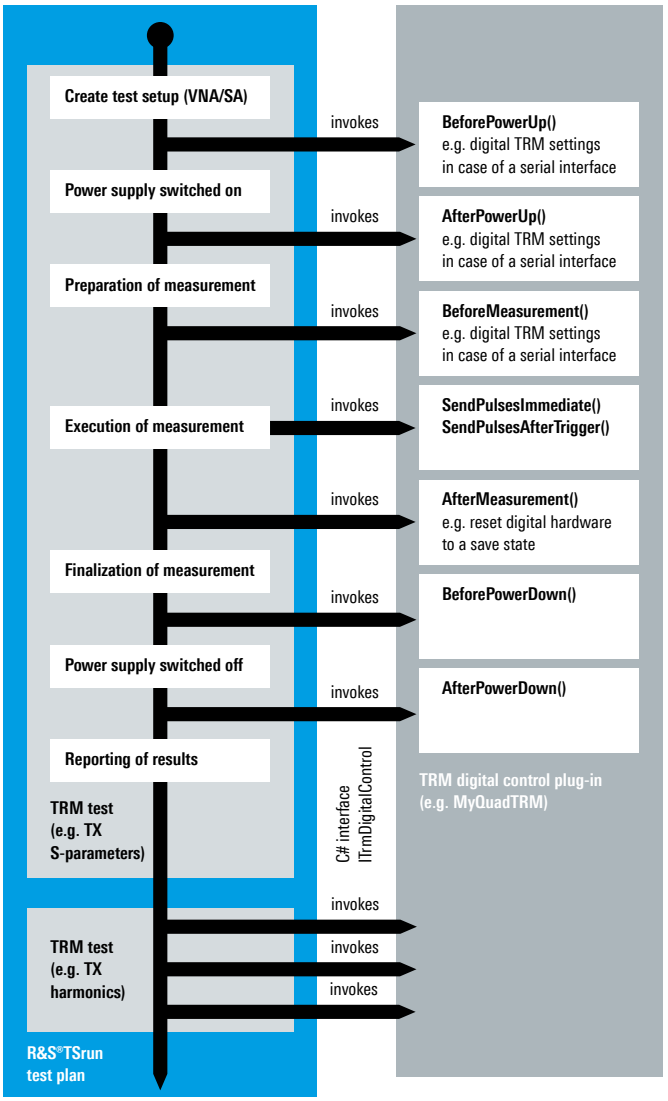
Each TRM features a radar-specific, confidential design and parameters and must be controlled by a specific interface, protocol and trigger for testing.

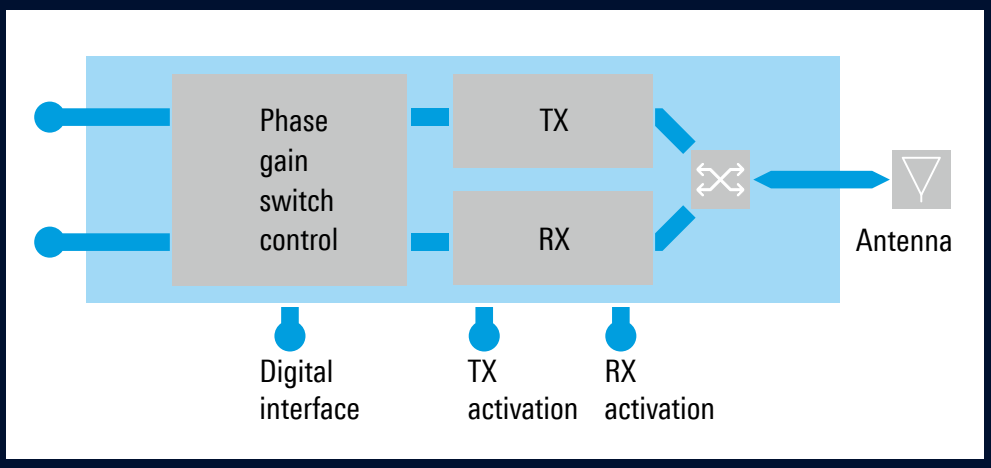
Rohde & Schwarz solution

The TRM test library features an open software interface for TRM control. The plug-in can be programmed locally and is compatible with any hardware. In combination with a wide range of test parameters, the whole test configuration can be carried out locally by the customer or Rohde & Schwarz, allowing fast adaptations and optimizations. The R&S®TSVP modular platform provides flexible and fast control interfaces as well as digital and analog measurements. This configuration enables very short test times in setups without any FPGA programming.

Want to learn more:
www.rohde-schwarz.com/manual/ts6/ chapter 3.3

Open DUT control and trigger interface





TRM block diagram.

Service that adds value

- ► Worldwide
- ► Local und personalized
- ► Customized and flexible
- ► Uncompromising quality
- ► Long-term dependability

Rohde&Schwarz

The Rohde&Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

Sustainable product design

- ► Environmental compatibility and eco-footprint
- ► Energy efficiency and low emissions
- ► Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

Rohde&Schwarz training

www.training.rohde-schwarz.com

Rohde&Schwarz customer support

www.rohde-schwarz.com/support

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Testing TRM performance of modern AESA antennas
Data without tolerance limits is not binding | Subject to change

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PD 5214.9873.32 V 01.00