AESA & antenna testing

TESTING TRM PERFORMANCE OF MODERN AESA ANTENNAS
YOUR CHALLENGE

Breakthrough technological advancements such as direct digital synthesis, phased arrays and GaN components have spawned a new breed of radar – multifunctional active electronically scanned array (AESA) radar. The AESA radar performance depends strongly on the TRMs (Transmit-Receive-Modules). The complexity and necessary performance of the TRMs require high effort in development and testing, which has an huge impact on time and cost.

Verifying the performance of individual TRMs in large arrays
An AESA radar consists of thousands of TRMs. Each TRM has to be tested for many different parameters. This testing limits the production throughput and requires investment in many parallel test systems. R&S has a long experience in time optimized routines and setups for TRM test, combining the high performance of the test equipment with fast handover between measurement and device control and handling of ten thousands of test results per TRM.

Reducing complexity and effort for TRM testing
The combination of different measurements of a TRM with different equipment, test setups and calibrations in combination with the large amount of test results makes the testing complex and error-prone. The automation SW supports multiple measurements just with network analyser and an optional spectrum analyser without reconnection. In combination with the integrated calibration routine this simplifies the setup ensuring full accuracy and high repeatability.

Turn-key systems and experience from a reliable partner
The development of AESA radars and the corresponding TRMs are already a high effort in time and resources. The additional effort required for implementing and optimization of testing in development and production increases this effort and increases time to market. Whereas the radar and TRM development is a core competency of a company, the test requirements for all TRM are very similar. Therefore R&S can support with its experience in TRM test, not only with high performance test equipment, but also test SW TRM Test Library up to complete TRM test system TS6710, based on a standard design with adaptations to the customer TRM specifics.

Testing TRMs with powerful test case libraries: fast and fully confidential
Even if the basic functionality of a TRMs are identical, each type of TRM is individual in its design, interfaces and parameters. This is the core know-how of any TRM or AESA manufacturer and hence subject to strict confidentiality. As a result, this often prevents from using standardized test solutions. The open DUT interface of the TRM test library allows local implementation of the interface to the TRM by customer, local integrator or R&S. With this SW interface any control HW can be interfaced locally. In addition time optimized control routines for all common communication interfaces (e.g. LVDS, RS422, RS485, TTL) are available by the modular platform TSVP to achieve very short test times.
SOLUTION FOR HIGHEST TEST SPEEDS AND THROUGHPUT

Introduction
Each AESA radar consists of a large number of TRMs. Each TRM has to be qualified and depending on the application also individually calibrated over a large number of DUT states and frequencies. Therefore test time is a crucial point, which defines the number of parallel running test systems in production.

R&S Solution
The R&S TRM Test Library is optimized to utilize the best speed out of the R&S test equipment in combination with fast handover between measurement and device programming. E.g. due to fast frequency sweeps and the possibility of 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 without interaction, including port multiplexing. The typical test time for a complete TRM characterization can be reduced from hours, required by legacy TRM test systems, to few minutes. The TRM Test System TS6710 proves this day by day in many countries worldwide.

Key benefits:
► Time optimized test cases with SW TRM Test Library
► Fully automated testing with signal condition unit
► Scalable solution up to turnkey test system

Want to learn more:
www.rohde-schwarz.com/product/ts6710
COVERING MULTIPLE TESTS WITH ONE SETUP

Introduction
The characterization of a TRM consists of many different measurements, typically requiring a bunch of different test equipment. This makes the setups complex in configuration, calibration and measurement. It is also error-prone, because easily a cable is not correct. And very often, if one equipment is not working correctly, the whole setup can not be used.

R&S Solution
The test SW TRM Test Library supports all typical TRM test cases just with network analyser. If a higher performance is required (e.g. pulsed noise figure) a spectrum analyser can be added. This results in reduced setups with less cabling. In combination with a signalling conditioning unit all tests including multiplexing can be carried out without any reconnection.

A special feature is the calibration routine in the SW: It collects all calibration requirements from a test and runs an optimized calibration without any compromise on accuracy. The support of multiport cal units allow efficient calibration of DUTs with many ports. The combination of simplified test setup with high degree of automation ensures reliable and reproducible measurements.

Want to learn more:

R&S®TS6 TRM

R&S®TS6 TRM test library test cases and typical hardware configurations

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<td></td>
<td></td>
<td><strong>CW, pulsed</strong></td>
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<td>S-parameter over DUT states</td>
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<td>●</td>
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</tbody>
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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
The development of a new AESA radar and especially a new TRM with its highly integrated components and specific features requires expertise and is a challenge for each company. Developing the corresponding test stations and test routines for development and production requires additional expertise in parallel and cuts resources from the development.

R&S Solution
A TRM development and production requires, independent from the specific TRM features, always similar test routines. The TRM Test Library covers this test routines based on the experience of many years of TRM test. The TRM specific requirements are set via parameters of the test cases in the SW. Different test cases and test plans can be cloned and configured for different tasks, e.g. component tests, module characterization or production. This makes repetitive measurements efficient and easy. The integrated report allows fast analysis and documentation, including pass-fail evaluation and detailed results. By this the effort required for testing can be reduced.

Want to learn more:
www.rohde-schwarz.com/product/ts6
Introduction:
On one hand the detailed TRM design and parameters is very often radar specific and confidential. In addition on the other hand each TRM must be controlled by a specific interface, protocol and trigger for testing.

R&S Solution:
The TRM Test Library has an open SW interface for TRM control. The plugin can be programmed locally and can interface to any hardware. In combination with the wide range of test parameters the whole test configuration can be carried out locally by the customer or Rohde & Schwarz. This also allows fast adaptations and optimizations.

As alternative the R&S®TSVP offers as modular platform flexible and fast control interfaces plus digital and analog measurement. In this configuration very short test times were achieved in many setups without any FPGA programming.

Want to learn more:
About 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.

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

Rohde & Schwarz GmbH & Co. KG
www.rohde-schwarz.com

Rohde & Schwarz training
www.training.rohde-schwarz.com

Regional contact
► Europe, Africa, Middle East | +49 89 4129 12345
customersupport@rohde-schwarz.com
► North America | 1 888 TEST RSA (1 888 837 87 72)
customer.support@rsa.rohde-schwarz.com
► Latin America | +1 410 910 79 88
customersupport.la@rohde-schwarz.com
► Asia Pacific | +65 65 13 04 88
customersupport.asia@rohde-schwarz.com
► China | +86 800 810 82 28 | +86 400 650 58 96
customersupport.china@rohde-schwarz.com